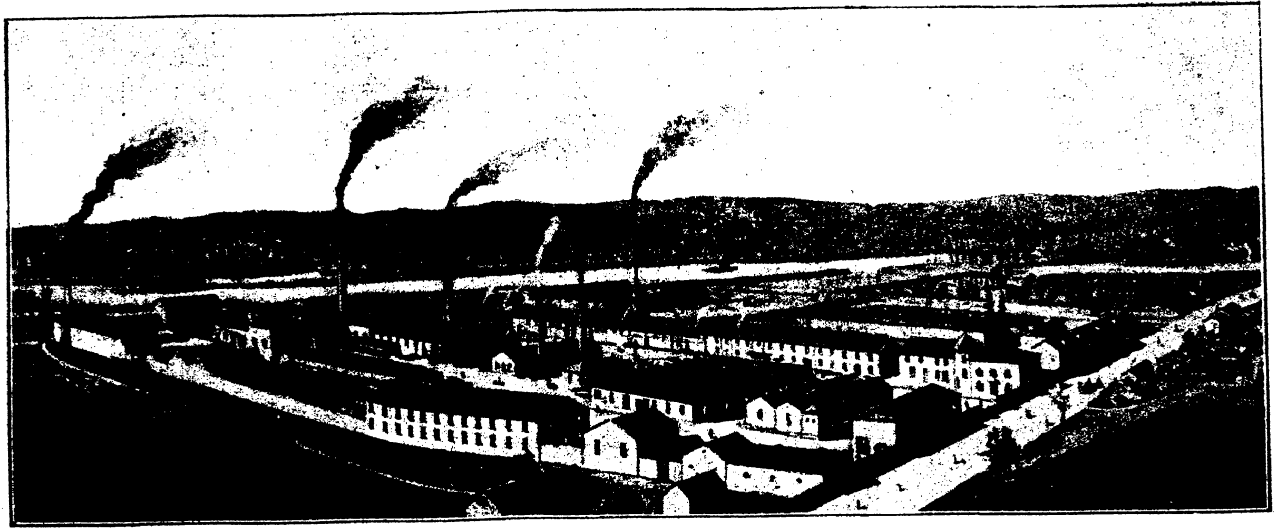
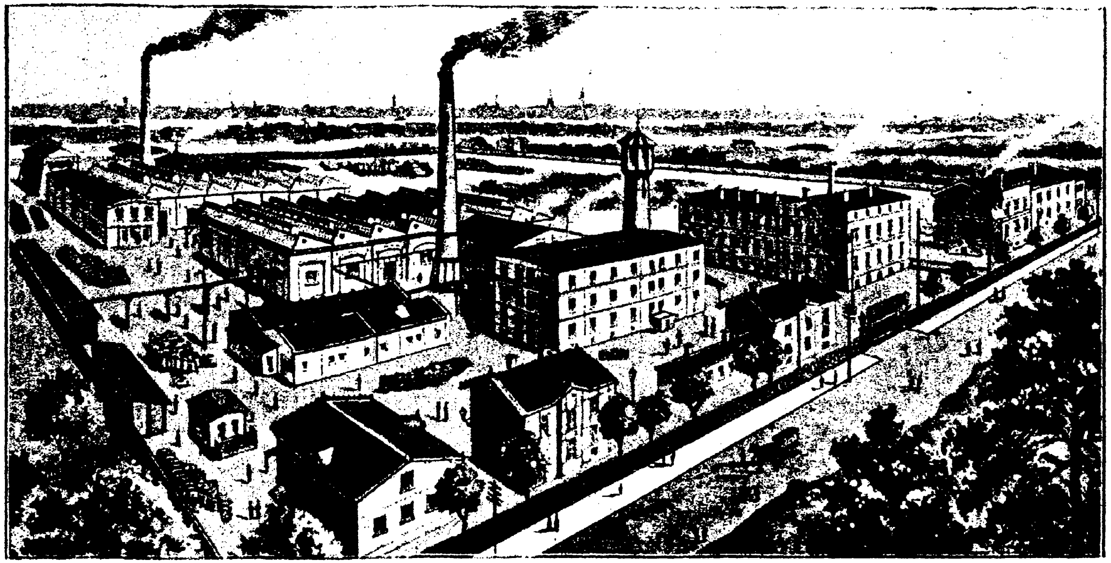
MANUFACTURE LYONNAISE DE MATIÈRES COLORANTES, LYONS.



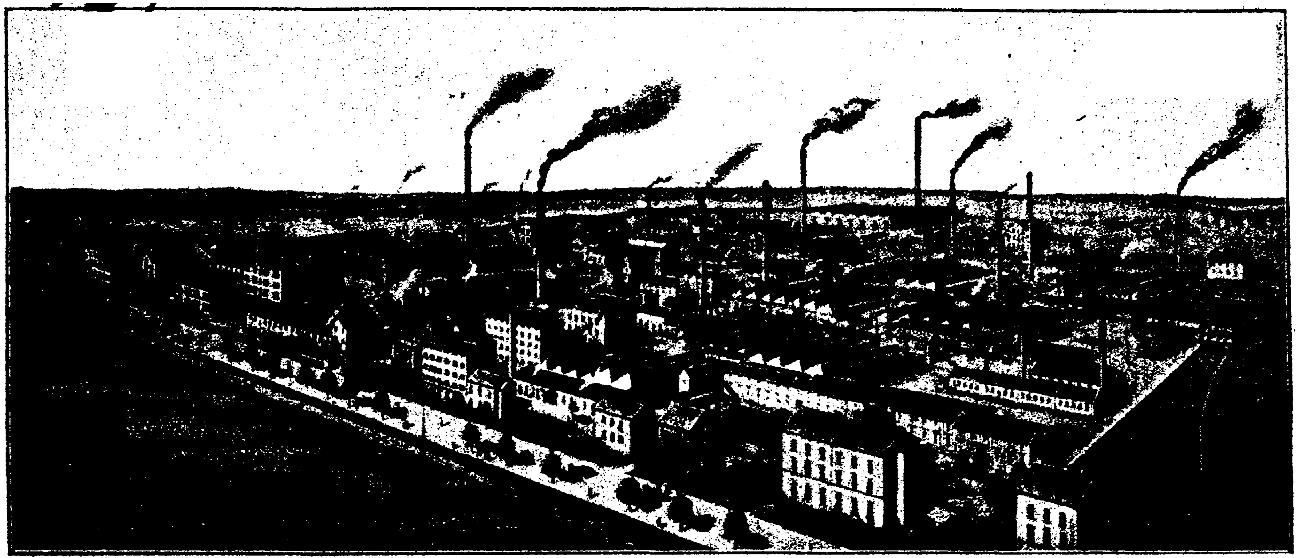
Works "La Mouche".

RUSSIAN ANILINE COLOUR WORKS LEOPOLD CASSELLA & Co., RIGA.



Works at Riga.

LEOPOLD CASSELLA & C^{o}., FRANKFORT o. M.



Works at Mainkur near Frankfort o. M.

THE DYEING OF COTTON

AND OTHER VEGETABLE FIBRES

WITH THE DYESTUFFS

OF

LEOPOLD CASSELLA & Co.

FRANKFORT o. M.

PUBLISHED BY
LEOPOLD CASSELLA & CO., FRANKFORT o. M.
1902.

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PREFACE.

In our book, "The Diamine Colours", issued in 1896, we gave the most comprehensive information with regard to the application of our Diamine Colours. The value of this work has been appreciated by all parties interested in dyeing, and it has become typical for later publications.

From time to time we have issued supplements to that book in accordance with the steady development of the Diamine Colours. Of late, however, the field of direct dyeing colouring matters has been extended in a most extraordinary degree by the introduction of our Immedial Colours, and cotton dyeing generally having made essential progress through the application of numerous new processes, we have decided to abstain from publishing a revised edition of the first book, and have instead prepared for our customers and friends the present manual, which embraces all departments and branches of modern cotton dyeing.

The tables in this book have been compiled with the greatest precision, and give a very clear description of the properties of the dyestuffs. The statements made with regard to the degrees of fastness are based on researches carried out with all possible accuracy, and the methods given for dyeing cotton in its various stages of manufacture (loose cotton, sliver, yarn, warps, pieces and hosiery goods) are throughout obtained by practical experience.

The application of mechanical apparatus, which has of late proved of such great importance for the dyeing of cotton and cotton goods, is described in its essential points. If in some cases the directions given should prove insufficient, we shall be pleased to supplement them by further information according to the particular requirements.

The hope expressed in our publication on the Diamine Colours in 1896 that we might be favoured with advice and communications from practice, which would prove useful for subsequent editions, has been most willingly responded to by many of our friends. We herewith beg to tender our best thanks to all for their valuable co-operation, and we take the liberty of soliciting a continuance of the same for the future.

Frankfort o. M., December 1902.

Leopold Cassella & Co.

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A. Diamine Colours.

Dissolving of the Diamine Colours.

The Diamine Colours are best dissolved in boiling water. If possible condensed water or water otherwise freed from lime should be used.

If only calcareous water should be obtainable, it is recommended to boil it first with a quantity of soda ash equal to the weight of the colour to be used and to add the dyestuff only subsequently.

A little stirring will, as a rule, dissolve the colour. The solution is best added to the dye bath after having been strained either through a piece of cotton cloth or through a fine sieve, so as to retain any undissolved parts, which must be brought into solution by washing the filter with hot water or by boiling again with water.

In order to save time, the dyestuffs are sometimes added undissolved to the bath. In this case, first some soda and then the colouring matter should be added to the bath, and the salt only after the bath has been well boiled up. We do not however consider it advisable to add the undissolved dyestuff to the bath when dyeing delicate shades, in fact, dissolving the dyestuffs previously should *always* be given the preference.

The Dyeing of Cotton with the Diamine Colours.

General Introduction.

The Diamine Colours are dyed at the boil with the addition of such neutral salts as Glauber's salt or common salt, and with or without the addition of alkaline salts like soap or soda.

The presence of alkaline salts retards the absorption of the colouring matter by the fibre, whereas neutral salts have the opposite effect; the more neutral salts the dye liquor contains, the more rapidly the absorption.

Difference between calcined and crystallised Glauber's salt and between soda ash and soda crystals.

Wherever in the following pages "Glauber's salt" and "soda" are mentioned, the anhydrous or *calcined* products, i. e. anhydrous sodium sulphate and soda ash respectively, are referred to. If the crystallised salts are preferred, then

for 100 parts of calcined Glauber's salt 220 parts of crystallised Glauber's salt, and
,, 100 ,, ,, soda ash 220 parts of soda crystals

should be taken.

The degree of purity of the salts is as a rule of secondary importance, and any of the commercial qualities of common salt may be used; when dyeing delicate shades, however, the purer salts, i. e. crystallised Glauber's salt instead of the calcined salt, and the refined salt instead of the raw article, should be employed.

Temperature and time of dyeing.

The Diamine Colours are usually dyed in a boiling bath or just below the boil, for about one hour.

Very light shades require only about 1/2 hour at 105—120° F.

In the case of dark shades it is advantageous, after dyeing at the boil, to allow the cotton to feed in the cooling bath, i. e. to dye only about 3/4 hour boiling and to allow about 1/4 to 1/2 hour for feeding.

Additions to the dye-bath.

The dye-bath is prepared

for *light* shades with:

1 % soda ash
1—2 % soap and
3—5 % sodium phosphate or (if preferred) Glauber's salt;

for *medium* shades with:

2 % soda ash
10 % Glauber's salt (calc.)

for *dark* shades with:

2 % soda ash
20 % Glauber's salt (calc.).

The soap used for light shades may be replaced by Turkey-red oil, and Glauber's salt in most cases by common salt, of which, however, 50 % more have to be used, e. g., for dark shades instead of 2 % soda ash and 20 % Glauber's salt:

2 % soda ash and
30 % common salt.

An exception to this general rule is made only in the case of Diamine Yellow N, which is dyed with soap and phosphate of soda, and Diamine Green G and B, which are dyed to better advantage with Glauber's salt without the addition of soda. For dark compound shades, however, a trifle of soda may in the case of Diamine Green be added.

The additions are best made in the following order: First the alkali (soda), then the colour solution, and finally the Glauber's salt or common salt. In the case of shades of uneven dyeing tendency the salt may be added in 2 or 3 portions after the dyeing has been progressing for some time.

The quantity of water in proportion to the weight of the material.

The degree of concentration of the dye liquor is an important factor when dyeing with the Diamine Colours. The more dilute the bath, the more difficult it is to exhaust, whereas the more concentrated the solution, the more readily the colouring matter is absorbed by the cotton.

Except in the production of very light shades, which must be dyed slowly and for which complete exhaustion of the bath is of little consequence, a dilute dye liquor offers no advantage, and in the case of dark shades the volume of water should therefore be reduced as much as possible. Practical working shows *that concentrated baths not only exhaust better but also produce deeper and fuller shades than can be obtained with the same quantity of dyestuff in more dilute baths.*

For this reason it is advisable to heat the dye-vessel with closed steam-coils wherever this is possible, and not with direct steam, since the latter on condensing increases the volume of the liquor.

It is difficult to give precise instructions with regard to the concentration of the dye liquor, but in any case the water used should never be more than 20—25 times the weight of the material to be dyed.

Exhaustion of the dye-baths.

In dyeing light shades, the baths are nearly always exhausted, whereas when medium or dark shades are produced; part of the dyestuff generally remains in the bath. The first or starting bath should consequently always be charged with an increased quantity of dyestuff. The quantities which are requisite primarily depend upon the volume of the dye liquor. As a general rule it may be stated that when dyeing dark shades in a volume of water

15—17 times larger than the weight of the cotton, about $^1/_4$
18—20 ,, ,, ,, ,, ,, ,, ,, ,, ,, $^1/_3$
20—25 ,, ,, ,, ,, ,, ,, ,, ,, ,, $^1/_2$

of the colouring matter remains in the bath.

The exhaustion of the dye-bath may be facilitated:

1) by increasing the quantity of salt. This is best effected by first dyeing with the normal quantities of salt and adding a further portion of salt only towards the end of the operation. In such cases the goods should be rinsed with water soon after being lifted from the dye-bath, as otherwise it will be more difficult to remove the salt which crystallises on the surface of the material.

2) by working with closed steam-coils.

3) by allowing the cotton to feed in the cooling bath.

Preserving the baths.

The unexhausted dye-baths may be used for dyeing subsequent lots. Even if they should happen not to have been used for some time and therefore have an ugly appearance and an unpleasant smell, boiling up will fully restore them and make them fit to be used again for months.

Additions of salt to the standing bath.

For continuous dyeing, the supplementary additions of soda and Glauber's salt should be about $^1/_4$ to $^1/_3$ of the original quantities used, e. g., $^1/_4$ being sufficient when dyeing in a concentrated liquor and $^1/_3$ when working in dilute liquor.

Use of the hydrometer.

Titrating the dye liquor offers an excellent means of controlling the quantity of salt present in the same.

To this end, some liquor should be allowed to cool in a small glass and its specific gravity be determined by means of the hydrometer.

Light shades being dyed with very little salt and the baths being very rarely kept for further use, titration is here of but little purpose. The best density of the dye liquor for medium shades may be assumed to be $1\,^1/_2$—2° Tw. and for dark shades 4—6° Tw. The liquor should always be titrated at the same temperature, i. e. after having perfectly cooled down. If the specific gravity of the liquor exceeds 6—7° Tw., the addition of salt may be dispensed with for the next lots, but care should be taken that the density is not below 6° Tw. for deep shades. In order to dye deep shades, the bath must contain a sufficient quantity of salt; an excess, on the other hand, will make the shades come out uneven; it is therefore advisable to regularly control the quantity of salt contained in the dye liquor.

Diamine Colours best suitable for compound shades.

All Diamine Colours may be considered to dye excellently level, both as self colours and in mixtures for dark compound shades. For the production of light and medium compound shades, however, such Diamine Colours only should be mixed as are possessed of the same good levelling power, i. e. yielding even shades, such as for instance:

Thioflavine S
Oxy Diamine Yellow GG
Diamine Fast Yellow B
Diamine Fast Yellow FF
Diamine Fast Yellow A
Diamine Orange D
Diamine Orange G
Oxy Diamine Orange G
Diamine Rose BD
Diamine Rose GD
Diamine Brilliant Scarlet S
Diamine Bordeaux B
Diamine Catechine B
Diamine Catechine 3G
Diamine Brown R
Diamine Brown S
Diamine Green G
Diamine Sky Blue FF
Diamine Sky Blue
Diamine Blue RW
Diamine Blue 2B
Diamine Blue 3B
Diamine Azo Blue 2R
Diamineral Blue R
Diaminogene B
Diamine Black BH
Diamine Dark Blue B.

Diamine Colours best suitable for shading.

Most of these dyestuffs are also very well suited for subsequently bringing the dyeing to the desired shade, but it is of special advantage for this purpose to further select such colours as can be kept ready in form of solutions, this having been found very convenient in practice. The solutions should contain about 1 lb of dyestuff for every 5 gallons of water and be prepared with condense water.

Dyestuffs suitable for this purpose are:

Diamine Fast Yellow B or FF as a yellowing agent,
Diamine Rose or Diamine Brilliant Scarlet S as a reddening agent,
Diamine Catechine 3G, Diamine Catechine B or Diamine Brown R as a brown element, and
Diaminogene B or Diamine Dark Blue B for saddening.

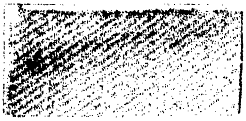
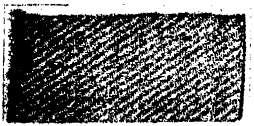
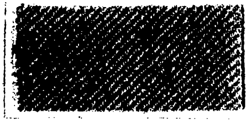
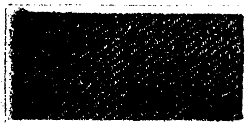
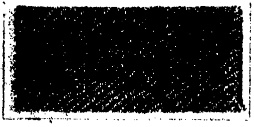
These solutions are used as required for shading purposes without regard to the colours with which the dyeings may have been produced originally.

I.

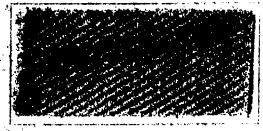
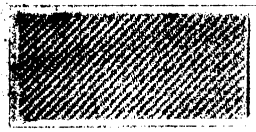
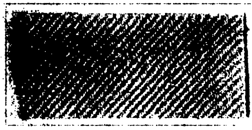
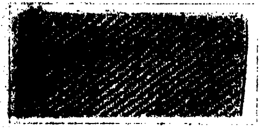
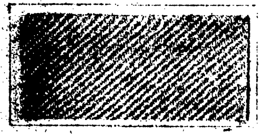
Direct Dyeings of the Diamine Colours

including a tabulation of their properties and fastness.

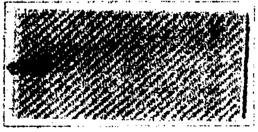
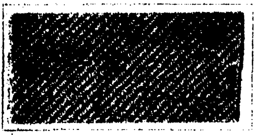
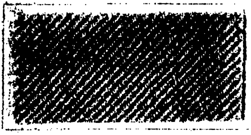
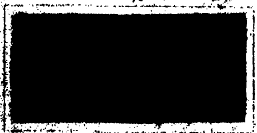
The Diamine Colours are classified according to their properties of fastness, "IV" denoting those which are fastest to light, i. e. equalling Indigo in this respect, whereas "I" indicates the lowest grade of fastness, similar to that of Congo Red.

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Thioflavine S pat. 1 %  2 % 	Normal, as indicated on page 7.	Good, in light as well as in deep shades. If washed with white cotton, the latter is not tinted in pale shades and only slightly in dark shades.	I.	Acetic acid 50 % turns the shade slightly redder.
Oxy Diamine Yellow GG 1 %  2 % 	Normal, as indicated on page 7.	Same as with Thioflavine S.	I.	Same as with Thioflavine S.
Diamine Yellow N pat. 1 % 2 % 	With the addition of 2 % soap and 5 % phosphate of soda.	Good in light and deep shades. Strongly alkaline washing turns the shade more reddish. White cotton washed with it is hardly stained in the case of light shades and somewhat more so in deep shades.	IV.	Acetic acid 50 % alters the shade but slightly.
Diamine Gold pat. ½ %  1 % 	Normal, as indicated on page 7. It is however recommended to allow the cotton to feed in the cooling bath, since the fibre absorbs the dyestuff but slowly.	The fastness to washing of light shades is good, that of medium and dark shades however is considerably less than that of Diamine Yellow N or Diamine Fast Yellow A and B.	IV. Slightly better than Diamine Yellow N.	Acetic acid or diluted hydrochloric acid hardly affect the shade at all.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Good. After being washed, the shade turns only a trifle redder and brighter.	III—IV.	Very good. Is not changed on being immersed in a 2°/₀ bath of chloride of lime for 5 or 6 hours.	Thioflavine S stands all kinds of aftertreatment, such as diazotising and developing, coupling, aftertreatment with metallic salts, without being materially altered in shade or in fastness.	*Dyes a brilliant lemon-yellow and serves for the production of light sulphur yellow and green shades, and generally, for brightening yellows. It is specially useful for discharge styles on account of its great resistance against discharging agents.*
Same as with Thioflavine S.	III—IV.	Not fast to chloring.	Same as with Thioflavine S with the exception that the shades become a little faster by aftertreatment with metallic salts.	*Oxy Diamine Yellow GG is used in dyeing for the same purposes as Thioflavine S. Its greenish-yellow shade is not quite so brilliant, but the dyeings work out at a lower cost.*
Same as with Thioflavine S.	IV.	Diamine Yellow N stands light chlorinating, but is less fast than Thioflavine S or Diamine Fast Yellow A or B.	The shade is not altered by diazotising and developing or coupling. The fastness to washing is materially improved by all kinds of aftertreatment with metallic salts, the shades becoming redder and fuller by treatment with sulphate of copper or bichromate of potash.	*Diamine Yellow N is used chiefly for light creams, but has been superseded by Diamine Fast Yellow A, B and FF which are better soluble.* *Diamine Yellow N is principally recommended for discharge styles, being of all yellows the best that can be discharged white with tin salt.*
Same as with Thioflavine S.	IV.	Very good. The shades even stand a 24 hours' immersion in chloride of lime 3° Tw.	Diamine Gold withstands the various aftertreatments, which however are not applied.	*Diamine Gold is recommended for brilliant light shades only, whereas the various brands of Diamine Fast Yellow are preferable as yellowing agents for compound shades.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Fast Yellow A 1 % 2 % 	Normal, as indicatod on page 7. Deep shades are dyed with an increased quantity of salt.	Diamine Fast Yellow A, same as Diamine Fast Yellow B and FF, number amongst the direct dyeing colours fastest to washing. White washed with it is not tinted in light shades and in deep shades very little.	III—IV.	Neither concentrated acetic nor diluted hydrochloric acid affect the shade.
Diamine Fast Yellow AR 1 %  2 % 	Same as with Diamine Fast Yellow A.	Same as with Diamine Fast Yellow A.	III—IV.	Same as with Diamine Fast Yellow A.
Diamine Fast Yellow B pat. 1 % 2 % 	Normal, as indicated on page 7.	Same as with Diamine Fast Yellow A.	IV. The fastness to light of Diamine Fast Yellow B is excellent and considerably better than that of Alizarine Yellow or Indigo.	Same as with Diamine Fast Yellow A.
Diamine Fast Yellow FF pat. 1 %  2 % 	Same as with Diamine Fast Yellow B.	Same as with Diamine Fast Yellow B.	IV. Same as with Diamine Fast Yellow B.	Same as with Diamine Fast Yellow B.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Very good.	IV.	Very good, like Diamine Gold.	Diamine Fast Yellow A stands all methods of aftertreatment without being to any extent altered in shade or affected in fastness.	*Diamine Fast Yellow A is superior to all direct dyeing yellow dyestuffs in fastness to washing. Its fastness to light is also very good, though not quite equalling Diamine Fast Yellow B in this respect. Amongst the yellow Diamine Colours, Diamine Fast Yellow A, B and FF find the most extensive application.*
Same as with Thioflavine S.	IV.	Very good, like Diamine Gold.	Same as with Diamine Fast Yellow A.	*Diamine Fast Yellow AR behaves exactly like Diamine Fast Yellow A and differs only by its more orange shade.*
The shade is a little brighter after rinsing.	IV.	Very good. The shades withstand even a 24 hours' immersion in a 2 °/o bath of chloride of lime.	Same as with Diamine Fast Yellow A.	*Is easily soluble and gives a clear solution. In addition to its excellent fastness to alkalis, acids and chlorines, it is exceedingly fast to washing and light and dyes perfectly level. It is therefore an excellent colour both for self shades and mixtures.* *Diamine Fast Yellow B serves also for shading dyeings to be diazotised, coupled or aftertreated, since it is not affected by any of these operations.*
Same as with Diamine Fast Yellow B.	IV.	Same as with Diamine Fast Yellow B.	Same as with Diamine Fast Yellow B.	*Diamine Fast Yellow FF possesses exactly the same properties as Diamine Fast Yellow B, differing only by its particular brightness of shade.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Yellow CP 1 %  2 % 	Normal, as indicated on page 7.	Is somewhat better to washing than Diamine Gold, but does not come up to Diamine Fast Yellow A, B or FF.	IV.	Acetic acid renders the shade somewhat duller; Diamine Yellow CP does not resist acids as well as Diamine Gold.
Diamine Orange G 1 %  2 %	Same as with Diamine Fast Yellow A.	Nearly, but not quite as good as Diamine Fast Yellow A.	III.	Acetic acid 50 % leaves the shade unchanged, dilute hydrochloric acid turns the shade somewhat more greenish.
Diamine Orange D 1 % 2 %	Same as with Diamine Fast Yellow A.	Same as with Diamine Orange G.	II—III.	Acetic acid 50 % turns the shade very slightly yellower.
Diamine Orange B 1 % 2 % 	Normal, as stated on page 7. After dyeing it is well to rinse thoroughly.	Same as Diamine Orange G, but white cotton washed with it becomes stained a little more.	II.	Neither concentrated acetic nor dilute hydrochloric acid cause any appreciable change.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Thioflavine S.	III—IV.	Same as with Diamine Gold.	Diamine Yellow C P stands all the usual methods of aftertreatment without changing in shade or being affected in fastness.	*Diamine Yellow C P is principally useful for dyeing golden yellows and is of an excellent fastness to light. By reason of its specially bright shade, this dyestuff is frequently used for producing olives and bronzes with a pronounced yellow cast.*
Same as with Diamine Fast Yellow B.	III—IV.	Very good.	Same as with Diamine Fast Yellow A.	*A yellowish orange, well suited for shading or for padding creams because of its good solubility, its fastness to light and washing and its not being sensitive to copper.*
Same as with Diamine Fast Yellow B.	III.	Good, though less resistant than Diamine Orange C in this respect.	By an aftertreatment with metallic salts neither shade nor fastness are materially affected. Diazotising and developing with Beta-Naphtol, or coupling, render the dyeings somewhat faster to washing.	*Surpasses all the other direct dyeing orange dyestuffs by its comparatively speaking very good fastness to washing and light. It is most frequently used for orange shades, but also for shading purposes.*
Very good.	III—IV.	Not fast to chloring.	Diazotising and developing, or coupling, do not effect a change in either shade or fastness. An aftertreatment with metallic salts enhances the fastness to washing considerably, and the fastness to light is improved by the use of sulphate of copper.	*Diamine Orange B is but little used for direct dyeing; it is however of great importance for the production of yellowish browns fast to light and washing, by aftertreating the dyeings with sulphate of copper and bichromate of potash.*

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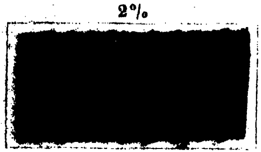
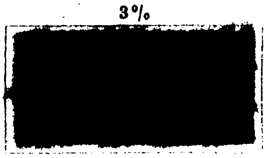
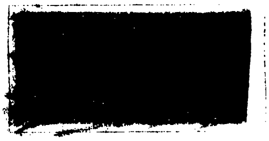
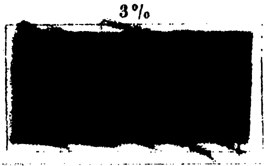
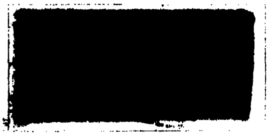
Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Oxy Diamine Orange G 1 % 3 % 	Normal, as indicated on page 7.	Both products behave similarly to Diamine Orange B.	II.	Acetic acid 50 % turns the shade somewhat yellower and duller.
Oxy Diamine Orange R 1 % 3 % 			I – II.	Acetic acid 50 % turns the shade a little redder and duller.
Cotton Brown A 2 % 4 % 	Normal, as indicated on page 7. It is advantageous to slightly exceed the usual quantity of salt.	Are only moderately fast to washing.	I—II.	Acetic acid turns the shade a little deeper.
Cotton Brown N 2 %  4 % 				

Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Orange B.	IV.	Not fast to chloring.	Both are very good products for coupling.	*Dyed direct they produce very bright useful orange shades; they are principally used for producing tan shades in dyeing yarns and hosiery.* *Oxy Diamine Orange G and R are very good products for coupling with Nitrazol, thereby yielding reddish browns fast to washing and milling; the R brand yields in this case dyeings that are brighter and faster to milling than those of "G".*
Same as with Diamine Orange B.	IV.	Not fast to chloring.		
After washing, the shade appears a little yellower.	IV.	Withstand a weak chlorination, but cannot be described as being fast to chloring.	Yield deeper shades of a better resistance to washing when developed with either Beta-Naphtol or Phenylene Diamine, or when coupled with Nitrazol.	*The very extensive application which these two brands enjoy is due to their bright, full shade, and their low cost.* *Besides being useful as self-shades, they are also serviceable for diazotising and coupling, thereby yielding shades much faster to washing and of greater intensity than direct dyeings.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Brown 3 G pat. 1 % 3 % 	Normal, same as indicated on page 7.	Is much superior in fastness to washing to the two Cotton Browns. White cotton washed with pale shades is but slightly tinted, but more so with medium and dark shades.	II—III.	The shade is not perceptibly changed by either concentrated acetic nor dilute hydrochloric acid.
Oxy Diamine Brown G 1 %  3 % 	With either Glauber's or common salt alone, without addition of soda. After dyeing, the goods must be well washed.	Similar to Diamine Brown 3 G.	II.	Acetic acid 50 % renders the shade a little darker.
Diamineral Brown G pat. 1 %  3 % 	Same as with Oxy Diamine Brown G.	Resistance to washing is similar as with Diamine Brown 3 G, but as alkalis turn the shade blackish-brown, the goods must be well rinsed after washing.	III—IV.	Acetic acid 50 % saddens the shade.
Diamine Brown V pat. 1 % 3 % 	Normal, as indicated on page 7. It is advisable to slightly exceed the usual quantity of soda.	The fastness to washing is good both in pale and dark shades. White cotton washed with it is hardly tinted at all by pale and but slightly stained by dark shades.	II—III.	Acetic or dilute hydrochloric acid turn the shade bluer.

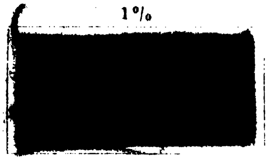
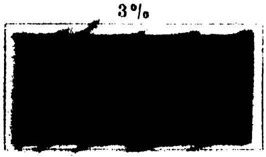
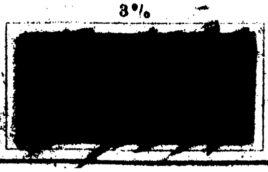
Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Very good.	III–IV.	Not fast to chloring.	Sulphate of copper alone or mixed with bichromate of potash enhances the fastness to washing and light considerably.	*Diamine Brown 3 G either alone or in combination with other Diamine Browns yields very good yellowish browns; the fact of its fastness to washing and light being improved by an aftertreatment with metallic salts renders the product of still greater value.*
The shade appears a little yellower after rinsing.	III–IV.	Not fast to chloring.	Developing with Beta-Naphtol or Phenylene Diamine yields cutch-brown shades fast to washing, whereas reddish brown shades very fast to washing are obtained by coupling with Nitrazol.	*Oxy Diamine Brown G possesses the same body of shade as Diamine Brown 3 G, but has greater tinctorial power taking value for value. This product is largely used for yellowish browns both in yarn and piece dyeing.* *By coupling with Nitrazol, deep reddish brown shades are obtained which are excellent in point of fastness to washing and are also very cheap.*
The shade appears a little yellower after rinsing.	II.	Not fast to chloring.	An aftertreatment with sulphate of copper, or sulphate of copper and bichromate of potash, enhances the fastness to washing and light considerably.	*Is equal in tinctorial power to Oxy Diamine Brown G, lacking however the same fulness. In point of fastness to light it is superior, being in this respect one of the fastest of the brown series.* *Diamineral Brown G is not only dyed direct, but is also used for producing shades which are to be aftertreated.*
The shade is a little bluer after rinsing.	II.	Not fast to chloring.	Developing with Beta-Naphtol or Phenylene Diamine yields dark brown, coupling with Nitrazol, puce brown shades.	*Is of importance for dark shades only and much favoured on account of its great tinctorial power and resistance to washing. It can be subsequently developed on the fibre either by diazotising or coupling.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Brown S pat. 1% ■ 3% ■	Normal, as indicated on page 7.	Similar to Diamine Brown V, but not quite so good.	II–III.	Same as with Diamine Brown V.
Diamine Brown M pat. 1% ■ 3% ■	Normal, as indicated on page 7.	Same as with Diamine Brown G.	III.	Acetic acid 50% renders the shade somewhat redder.
Diamine Brown B pat. 1% ■ 3% ■	Normal, as indicated on page 7.	Same as with Diamine Brown V.	III.	Similar to Diamine Brown M, but not turning quite so red.
Diamine Brown R 1% ■ 3% ■	Same as with Oxy Diamine Brown G.	Same as with Diamine Brown 3G.	III.	Acetic acid blackens the shade; in this respect it is surpassed by Diamine Brown M.

Dyeings.

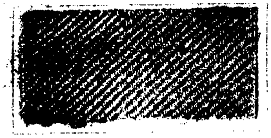
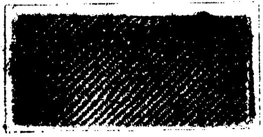
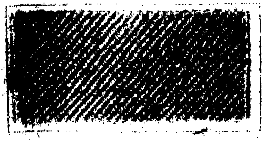
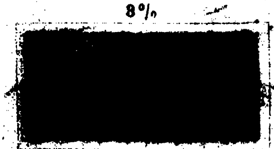
Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Brown V.	II.	Not fast to chloring.	Same as with Diamine Brown V.	*Behaves like Diamine Brown V, but is better in point of fastness and in dyeing level. Besides for direct shades it also serves for producing dark browns by the diazotising and the coupling processes.*
The original shade is restored after rinsing.	II.	Not fast to chloring.	May be aftertreated with the various metallic salts, but the best combination is the following: 2 % sulphate of copper 2 % bichromate of potash 2 % acetic acid. Diamine Brown M can besides be developed with either Beta-Naphtol or Phenylene Diamine.	*Diamine Brown M and B rank amongst the best direct dyestuffs and are eminently suitable for being aftertreated.* *The aftertreatment may be done with either sulphate of copper alone or with sulphate of copper and bichromate of potash mixed, the latter method yielding shades fastest to washing.*
Same as with Diamine Brown M.	II.	Not fast to chloring.		
Not fast to stoving.	II.	Not fast to chloring.	Can, like Diamine Brown M, be aftertreated with metallic salts, the fastness to washing and light being thus enhanced. The effect is however not equal to that obtained with dyeings of Diamine Brown M.	*Diamine Brown R possesses the same clearness of shade as the Cotton Browns which it surpasses in point of fastness to washing and light. It is chiefly to be considered for dyeing cheap imitations of cutch browns on loose cotton, yarns and hosiery.* *It must also be pointed out that Diamine Brown R can be much more easily discharged than any other direct brown.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Catechine B pat. 1 % 3 % 	Normal, as indicated on page 7.	Both brands behave like Diamine Brown S and may be counted amongst the direct dyestuffs fastest to washing; an aftertreatment with bichromate of potash and sulphate of copper improves this fastness to washing considerably, and such dyeings may be used for milling goods.	III.	Same as with Diamine Brown B.
Diamine Catechine G pat. 1 %  3 % 	Normal, as indicated on page 7.		II – III.	Acetic acid 50 % leaves the shade unaltered, dilute hydrochloric acid turns the shade slightly duller.
Diamine Catechine 3 G pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Catechine G.	II – III.	Acetic acid produces a greener shade. Diamine Catechine 3 G is in point of fastness to acids inferior to Diamine Catechine G.
Diamine Bronze G pat. 1 % 3 % 	Best dyed without the addition of soda, e. g. with Glauber's salt or common salt only.	Very fast to washing in both pale and dark shades, white washed with it is not stained by pale and only slightly by dark shades.	II—III.	Acetic acid 50 % or dilute hydrochloric acid redden the shade but slightly.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shade appears a trifle redder after rinsing.	IV.	Not fast to chloring.	Like Diamine Brown M, both dyestuffs may be fixed with metallic salts and thus be rendered fast to washing.	*Diamine Catechine B is one of the dyestuffs used most frequently both for yarns and pieces as well as for loose cotton.* *It is particularly noted for dyeing excellently level.* *By a combination of Diamine Catechine B, Diamine Fast Yellow B and Diamine Dark Blue B, the majority of drab shades may be produced quite level.*
Not fast to stoving.	III—IV.			*Diamine Catechine G is principally employed for dyeing yellowish brown cutch shades, but is less suitable for piece goods than Diamine Catechine B and 3 G.* *An aftertreatment with metallic salts fixes the dyeings fast to washing and light.*
The shade remains somewhat yellower after rinsing.	III—IV.	Not fast to chloring.	Like Diamine Catechine G and B.	*Diamine Catechine 3 G is much yellower in shade than Diamine Catechine G.* *It is of particular importance as a means for shading modes.*
The shade is a trifle browner after rinsing.	II—III.	Not fast to chloring.	For aftertreatment chromium fluoride or chrome-alum come into consideration in the first instance. Diamine Bronze G is also used for coupled dyeings.	*Diamine Bronze G is very suitable for mode shades and is extensively used for dyeing yarns and loose cotton.* *The shades may be fixed fast to milling both with chromium fluoride and by being coupled.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Nitrazol Brown BD pat 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Diamine Brown S.	II.	Acetic acid 50 % alters the shade but little, dilute hydrochloric acid turns it somewhat redder.
Diamine Nitrazol Brown RD pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Oxy Diamine Brown G.	II.	The shade becomes duller with acetic acid 50 %.
Diamine Nitrazol Brown T pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Oxy Diamine Brown G.	II.	Acetic acid 50 % turns the shade a little bluer.
Diamine Grey G pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Very good in both pale and medium shades.	III.	Acetic acid 50 % or dilute hydrochloric acid effect a hardly appreciable change in the shade.

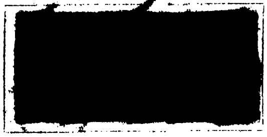
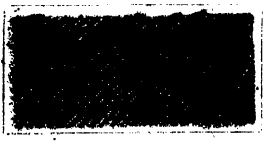
Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shade remains slightly yellower after rinsing.	III—IV.	Not fast to chloring.	By coupling with Nitrazol, dark browns fast to washing are obtained. The three dyestuffs may also be rendered fast to washing by developing with either Beta-Naphtol or Phenylene Diamine.	*Diamine Nitrazol Brown B D and R D are useful not only for coupled but also for direct dyeings, which combine with comparatively good fastness to washing a special depth of shade. Their principal application is in the hank dyeing and hosiery trade, their property of also dyeing well with soap and soda only being particularly useful.*
The shade remains slightly bluer after rinsing.	III—IV.	Not fast to chloring.		
Same as with Diamine Nitrazol Brown B D.	III.	Not fast to chloring.		*Behaves like the two previous brands and comes into consideration for producing direct reddish browns.*
Very good.	IV.	Not fast to chloring.	A treatment with bichromate of potash and sulphate of copper after dyeing renders the shade fast to washing and to light. Coupling with Nitrazol produces olive-browns fast to washing.	*Serves for producing greys of good fastness to light and hot pressing.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Rose BD pat. 1/4 % 1/2 % 	Normal, as indicated on page 7.	The fastness to washing of medium and dark shades is not better than that of any other direct red, but that of their pale pink shades is very good.	III.	Acetic acid 50 % turns the shade slightly yellower.
Diamine Rose BG pat. 1/4 %  1/2 % 				Same as with Diamine Rose BD.
Diamine Rose GD pat. 1/4 %  1/2 % 				Acetic acid 50 % does not change the shade.
Diamine Red 4B 1 %  8 % 	Normal, as indicated on page 7, or with the addition of 2 % soda 2 % soap 10 % Glauber's salt.	Very good in pale and medium shades; white washed with darker shades is stained but slightly.	I.	Not fast to acids.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shades appear somewhat brighter after rinsing.	III - IV.	Resist weak chlorination.	Do not come into consideration for aftertreatment.	*The Diamine Rose brands find extensive application for producing pinks by dyeing and padding.* *There are besides in the market: Diamine Rose B extra, a concentrated form of B D, and Diamine Rose G G N which latter yields more yellowish tints of pink than B G.*
The shade is somewhat paler after rinsing.	II – III.	Withstands a weak chlorination, if lasting a few minutes only.	Does not come into consideration for aftertreatment.	*The dyestuff is very largely used for cheap plain reds which are distinguished by their special brightness and their relatively good fastness to washing.*

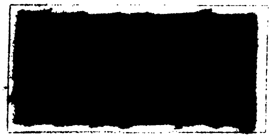
Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Red 10 B pat. 1 % 3 % 	Normal, as indicated on page 7.	Of approximately the same fastness to washing as Diamine Red 4 B, though not quite so good.	I.	Not fast to acids.
Diamine Scarlet B pat. 1 % 3 % 	With 1 lb Glauber's salt and 3/4 oz Turkey-red oil per 10 gallons of liquor and without addition of soda. The Diamine Scarlets may however be dyed with the usual additions if used for shading purposes.	Relatively good in pale, but only moderately so in dark shades.	I., in pale shades II.	Acetic acid 50 % turns the shade slightly yellower.
Diamine Scarlet 3 B pat. 1 % 3 % 				
Diamine Brilliant Scarlet S 1 % 3 % 	With Glauber's or common salt, but without soda.	Somewhat faster to washing than Diamine Scarlet B.	I.	Acetic acid 50 % does not affect the shade.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shade remains unaltered after rinsing.	III – IV.	Not fast to chloring.	Same as with Diamine Red 4 B.	*Diamine Red 10 B is of a clear bluish red shade and serves for shading as well as for dyeing bright clarets.*
Same as with Diamine Red 4 B.	III – IV.	Resists a weak chloride of lime solution fairly well.	Do not come into consideration for aftertreatment.	*Diamine Scarlet B comes less into consideration for solid reds, but being an easily levelling colour is chiefly employed for shading purposes.*
Same as with Diamine Red 4 B.	II – III.	Somewhat better than Diamine Scarlet B.		*Diamine Scarlet 3 B may be employed both for solid reds and for compound shades. It is specially well suited for dyeing bluish scarlets (crimsons).*
Very good.	III – IV.	Not fast to chloring.	Does not come into consideration for aftertreatment.	*Diamine Brilliant Scarlet S yields very bright scarlet shades, which are not influenced by organic acids.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Red 5 B pat. 1 °/₀ 3 °/₀ 	Same as with Diamine Red 4 B.	Approximately same as with Diamine Red 4 B.	II.	Same as with Diamine Red 4 B.
Diamine Red 6 B pat. 1 °/₀  3 °/₀ 			I—II.	
Diamine Fast Red F pat. 1 °/₀ 3 °/₀ 	Normal, as indicated on page 7.	Good in pale shades, in deep shades moderately so, but better than Diamine Scarlet. A treatment with chromium fluoride after dyeing increases the fastness to washing very considerably.	III.	Acetic acid 50 °/₀ does not affect the shade. Dilute hydrochloric acid turns the shade bluer.
Diamine Red D pat. 1 °/₀ 3 °/₀ 	Normal, as indicated on page 7.	Same as with Diamine Fast Red F.	II – III.	Not fast to acids.

Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Scarlet B.	III.	Not fast to chlorine.	Do not come into consideration for aftertreatment.	*Diamine Red 6 B is the brighter of the two brands and Diamine Red 5 B somewhat faster to light.*
	III.	Not fast to chlorine.		
Same as with Diamine Scarlet B.	III—IV.	Not fast to chlorine.	The fastness to washing and acids is materially increased by a subsequent treatment with chromium fluoride or chrome alum.	*By reason of its excellent fastness to light, which surpasses that of all other direct dyestuffs, this colour finds most extensive application both for yarn and piece dyeing, especially for tapestry and linen goods and as a substitute for barwood in dyeing warps for plushes.*
Same as with Diamine Scarlet B.	III—IV.	Not fast to chlorine.	Cannot be fixed so well as Diamine Fast Red F with chromium salts.	*Is in shade somewhat brighter than Diamine Fast Red F, which it may replace as long as the great fastness of Diamine Fast Red F is not essential.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Bordeaux B pat. 1 % 3 % 	Normal, as indicated on page 7.	Somewhat faster than Diamine Fast Red F. Pale shades washed with white cotton tint the latter but slightly, darker shades more so.	III.	Not fast to acids.
Diamine Bordeaux S pat. 1 %  3 % 	Normal, as indicated on page 7.	Same as with Diamine Bordeaux B.	II.	Acetic acid 50 % turns the shade somewhat yellower.
Diamine Violet Red pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Bordeaux B.	I.	Not fast to acids.
Diamine Violet N pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Fast Red F.	III.	Acetic acid 50 % turns the shade somewhat bluer.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Fast Red F.	III—IV.	Not very fast to chlorine.	May be used for shading those dyeings which are to be diazotised and developed, but does not come into consideration for the other methods of aftertreatment.	*Diamine Bordeaux B surpasses the competing colours by its superior fastness to washing and light. In the latter respect it is nearly as good as Diamine Fast Red F and better as regards fastness to washing.*
The shade appears slightly bluer after rinsing.	II.	Resists well a weak chloride of lime solution.	Diamine Bordeaux S stands well a treatment with sulphate of copper and is thereby improved in point of fastness to light. It may therefore be used for shading dyeings to be aftertreated or coupled.	*In consequence of its good resistance to acids, this product is chiefly used for clarets and dark reds where fastness to organic acids is conditional.*
Same as with Diamine Bordeaux S.	III.	Not fast to chlorine.	Does not come into consideration for aftertreatment.	*Is a bordeaux which is sensitive to acids but yields very bright shades, and is chiefly used for dyeing clarets, mulberry and ruby shades at a low cost.*
Same as with Diamine Bordeaux S.	III--IV.	Resists a weak chloride of lime solution if subjected to same for only a few minutes.	Same as with Diamine Bordeaux B.	*Besides its use for producing direct shades of pure violet and heliotrope, Diamine Violet N is also frequently employed for shading purposes and is distinguished by its excellent fastness to light.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Oxy Diamine Violet B pat. 1 % 3 % 	Normal, as indicated on page 7.	The dyeings are, comparatively speaking, fast to washing. Pale shades washed with white cotton stain the latter but little, dark shades more so.	II—III.	Acetic acid 50 % changes the shade but very triflingly.
Oxy Diamine Violet R pat. 1 % 3 % 				
Oxy Diamine Violet G pat. 1 % 3 % 				Acetic acid 50 % turns the shade somewhat bluer.
Diamine Heliotrope G pat. 1 % 3 % 	Normal, as indicated on page 7.	The fastness to washing is the same as that of Oxy Diamine Violet R.	II—III.	Same as with Oxy Diamine Violet G.

Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamime Bordeaux S.	II.	Not fast to chlorine.	Neither their shades nor their fastness being affected thereby, all three products may to advantage be used for shading dyeings which have to be diazotised and developed, or coupled.	*Oxy Diamine Violet B, R and G are used for dyeing violet, mulberry and prune shades at a low cost.*
	II.			
	II—III.			
The shade becomes but very little bluer.	II.	Not fast to chlorine.	In distinction from the Oxy Diamine Violets, the Diamine Heliotropes may be diazotised on the fibre and developed with Beta-Naphtol, thus yielding navies of good fastness to acids.	*Approaches Oxy Diamine Violet R in shade but is considerably brighter.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Heliotrope O pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Diamine Heliotrope G.	II—III.	Same as with Diamine HeliotropeG.
Diamine Heliotrope B. 1 % ■ 3 % ■			II.	Is hardly changed by either acetic acid or dilute mineral acids.
Oxy Diamine Blue 3R pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Oxy Diamine Violet B.	II.	Acetic acid 50 % or dilute mineral acids hardly cause a perceptible change.
Diamine Blue 3R pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Similarly to the other direct dyeing bright blues, this colour possesses good fastness to washing, but white cotton washed with it is stained a little.	I—II.	Acetic acid 50 % turns the shade slightly bluer, hydrochloric acid slightly saddens it.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Similar to that of Diamine Heliotrope G.	II.	Not fast to chlorine.	Behave like Diamine Heliotrope G when developed.	*Diamine Heliotrope O yields a somewhat more violet shade than G, whilst Diamine Heliotrope B is the bluest violet of this series. Both colours are employed for dyeing violet and claret shades, and if brightness is of consideration, they are to be given the preference over the Oxy Diamine Violets.*
	II.			
The shade turns slightly bluer after rinsing.	II—III.	Not fast to chlorine.	Can be used for shading dyeings which are to be diazotised and developed, coupled, or aftertreated.	*Chiefly used for navies with a violet cast. Its great tinctorial power renders it possible to produce these shades at a relatively low cost.*
Very good.	I—II.	Not fast to chlorine.	A subsequent treatment with sulphate of copper turns the shade more violet but renders it fast to light.	*Diamine Blue 3R is the reddest of the bright Diamine Blues and is largely used for deep blues with a coppery cast.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Azo Blue R pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue 3 R.	II.	Neither acetic acid 50 % nor dilute hydrochloric acid affect the shade.
Diamine Azo Blue 2 R pat. 1 % 3 % 				Acetic acid 50 % and dilute hydrochloric acid turn the shade a little redder.
Diamine Blue BX pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue 3 R.	I—II.	Neither acetic acid 50 % nor dilute hydrochloric acid change the shade perceptibly.
Diamine Blue RW pat. 1 % 3 % 	Normal, as indicated on page 7.	Somewhat better than Diamine Blue 3 R.	I.	Same as with Diamine Blue BX.

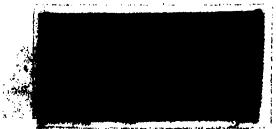
Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shade appears a little clearer after rinsing.	II—III.	Not fast to chlorine.	Specially suitable for developing with Beta-Naphtol and Naphtylamine Ether, thus yielding bluish-violet shades.	*These colours are both extensively used for direct as well as developed dyeings.*
Very good.	II.	Not fast to chlorine.	Does not come into consideration for aftertreatment.	*Diamine Blue BX counts amongst the most extensively used Diamine Blues. Besides for navies, it is also used for dyeing cheap dark blues in combination with the various Diamine Blacks.*
Very good.	III—IV.	Not fast to chlorine.	Well adapted for aftertreatment with sulphate of copper.	*Direct dyeings of Diamine Blue RW are distinguished for their particularly bright shade. RW is, however, of still greater practical value for producing dyeings fast to light by an aftertreatment with sulphate of copper.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Brilliant Blue G pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue 3 R.	I – II.	Neither acetic acid 50 % nor dilute hydrochloric acid effect a change.
Diamine Blue BG pat. 1 % 3 % 				
Oxy Diamine Blue R. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue 3 R.	I.	Same as with Diamine Brilliant Blue G.
Oxy Diamine Blue G. 1 % 3 % 				

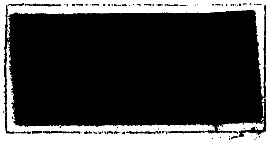
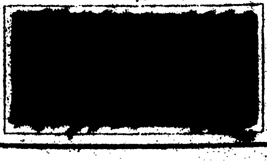
Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Stoving turns the shade somewhat brighter.	I - II.	Resists a weak chloride of lime solution.	A subsequent treatment of the shades with sulphate of copper renders them very fast to light.	*Possesses the same brightness as Diamine Blue RW and a slightly redder and fuller shade. Diamine Brilliant Blue G is largely used for bright blues on yarn and pieces. A treatment with sulphate of copper after dyeing improves its fastness to light considerably.*
Very good.	I—II.	Not fast to chlorine.	Less suitable for aftertreatment than Diamine Brilliant Blue G.	*Whilst behaving like Diamine Brilliant Blue G, it is somewhat fuller in shade.* *Diamine Blue BG is only used for direct dyeings.*
Very good.	I.	Not fast to chlorine.	Both may be aftertreated with sulphate of copper, whereby they yield shades very fast to light which do not however resist washing as well as the other products amenable to aftertreatment with copper salts.	*The extensive application of the two Oxy Diamine Blues is due to their brightness and their low price.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Blue 2 B pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue RW.	I—II.	Same as with Diamine Blue BX.
Diamine Blue 3 B pat. 1 % 3 % 				
Diamine Sky Blue pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue RW.	II.	Same as with Diamine Blue BX.
Diamine Sky Blue FF pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue RW.	II.	Same as with Diamine Blue BX.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Very good.	III.	Not fast to chlorine.	Greys very fast to washing may be obtained by diazotising and developing with: Beta-Naphtol, Alpha-Naphtol, or Phenylene Diamine.	*The two products are chiefly of importance for pale and medium shades and have besides the advantage of changing but little in hot drying or ironing.*
Very good.	III—IV.	Not fast to chlorine.	Same as with Diamine Blue 3B.	*Owing to its eminently pure and bright shade, it is largely used for padding light shades, for dyeing bright blues, and for shading purposes.*
Same as with Diamine Sky Blue.	III—IV.	Not fast to chlorine.	Well adapted for aftertreatment with sulphate of copper.	*It is used for the same purposes as Diamine Sky Blue, which it even surpasses in brightness of shade.* *An aftertreatment with sulphate of copper produces greenish blue shades, which are very fast to light and which are of as great importance as those obtained with Diamine Blue RW.*

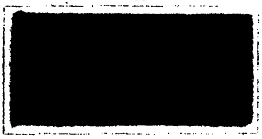
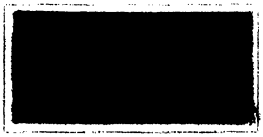
Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine New Blue R pat. 1 % 3 % 	Normal, as indicated on page 7.	Better than Diamine Blue 3 R.	II.	Neither acetic acid 50 % nor dilute hydrochloric acid effect a change in shade.
Diamine Blue C4B pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine New Blue R.	II.	Same as with Diamine New Blue R.
Diamineral Blue R pat. 1 % 3 % 	Normal, as indicated on page 7. In dyeing Diamineral Blue R, the addition of soda is important, as it renders the resulting shades more intense.	In point of fastness to washing Diamineral Blue R is one of the best dyestuffs of this series.	II—III.	Not changed by either acetic acid 50 % or dilute hydrochloric acid.
Diamine Deep Blue R pat. 1 %  3 % 		Same as with Diamineral Blue R.	II—III.	Same as with Diamineral Blue R.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Very good.	II—III	Not fast to chlorine.	An aftertreatment with sulphate of copper renders the shades very fast to light.	*Diamine New Blue R does not come up in brightness of shade to the other Diamine Blues, but is a little superior to these in fastness to washing and light.* *Treated with sulphate of copper after dyeing, it yields results similar to those obtained with Diamine Brilliant Blue G.*
Very good.	III.	Not fast to chlorine.	By an aftertreatment with sulphate of copper, shades very fast to light may be obtained which behave similarly to those obtained with Diamine Sky Blue FF.	*Stands in shade between Diamine Blue RW and Diamine Sky Blue though not quite of the same brightness. It, however, possesses good fastness to washing and light, which may be still further improved by a treatment with sulphate of copper.*
Very good.	III—IV.	Not fast to chlorine.	Well adapted for aftertreatment with either sulphate of copper or with a combination of sulphate of copper and bichromate of potash.	*Diamineral Blue R is one of the best of its group in point of fastness to washing and light, enjoying a most extensive application in dyeing navies and dark blues. Dark shades show the same coppery appearance peculiar to Indigo dyeings.* *Diamine Deep Blue R behaves not unlike Diamineral Blue R, it may be aftertreated with sulphate of copper and is chiefly used for heavy, deep shades which otherwise cannot be obtained with Diamineral Blue R.* *Diamineral Blue R and Diamine Deep Blue R are frequently used for bottoming Indigo-dyed goods, also for dyeing the well-known blue cloth which is first dyed with Diamineral Blue R and topped with Naphtindone. Their excellent fastness to hot ironing is also of great value in the piece-dyeing trade.* *A second brand called Diamine Deep Blue B behaves similarly to Diamine Deep Blue R, only yielding dyeings of a somewhat more greenish cast and of not quite the same brightness.*
Same as with Diamineral Blue R.	III—IV.	Not fast to chlorine.	Same as with Diamineral Blue R.	

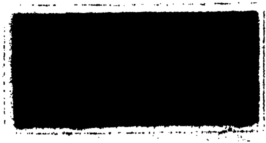
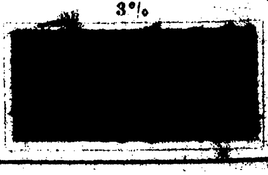
Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Blue N C pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine New Blue R.	II.	Dilute mineral acids turn the shade but slightly redder.
Diamine Fast Blue C pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamineral Blue R.	IV.	Acetic acid 50 % or dilute hydrochloric acid turn the shade but very slightly towards violet.
Diamine Fast Blue CG pat. 1 % 3 % 				
Diamine Steel Blue L pat. 1 %  3 % 	Normal, as indicated on page 7.	Same as with Diamineral Blue R.	II.	Same as with Diamine Blue BX.

Dyeings.

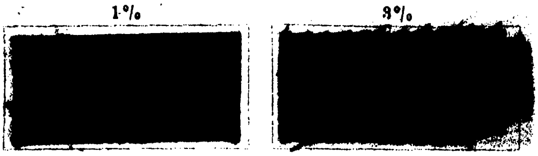
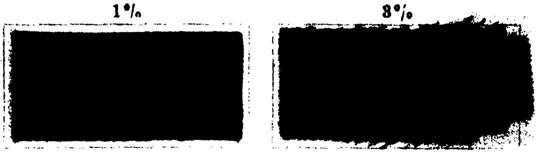
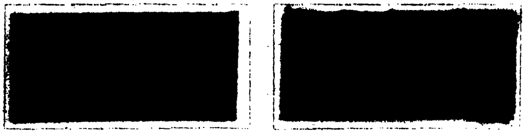
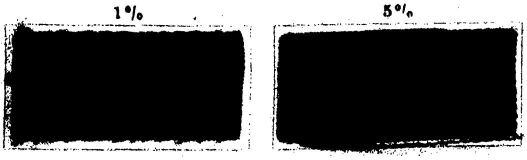
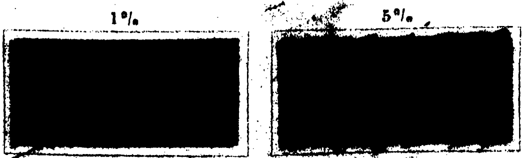
Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Very good.	II.	Not fast to chlorine.	Aftertreated with Nitrazol, Diamine Blue NC yields blue black shades and is therefore used for shading and saddening coupled dyeings.	*Diamine Blue NC serves in the first instance as a blue black coupling colour, it is, however, also of interest when dyed direct on account of its relatively bright shade and of its dyeing easily level, thus rendering it useful for dyeing in machines.*
Very good.	III.	Not fast to chlorine.	The dyeings may be aftertreated with sulphate of copper, though the excellent fastness to light of the direct dyeings is not improved to any extent by this aftertreatment.	*The intrinsic value of these colours lies in their excellent fastness to light, which surpasses that of Indigo considerably.* *The two brands are used for dyeing blues on yarns and pieces, also for shading and saddening compound mode shades.* *Diamine Fast Blue C yields brighter blues than Diamine Fast Blue CG, the latter being better adapted for shading.*
Same as with Diamineral Blue R.	IV.	Resists the action of a weak chloride of lime solution if immersed for a very short time.	Can be used for shading dyeings to be aftertreated.	*Diamine Steel Blue L serves for producing greenish blues and is also used in the dyeing of various compound shades, such as Olives etc.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Green B pat. 1 % 3 % 	With Glauber's or common salt only, without addition of any soda ash which should specially be avoided whenever copper vessels are employed.	The fastness to washing is better than that of the direct dyeing blues. White washed with pale shades is stained very little, with dark shades more so.	II—III.	Acetic acid 50% turns the shade slightly bluer.
Diamine Green G pat. 1 %  3 % 	With Glauber's or common salt only. When used in combination with other colours, Diamine Green G may also be dyed in the presence of soda.			
Diamine Dark Green N pat. 1 %  3 % 	Same as with Diamine Green G.	Same as with Diamine Green B.	II.	Same as with Diamine Green B.
Diamine Black RO pat. 1 % 3 % 	Normal, as indicated on page 7. The addition of some soda along with the Glauber's salt is however generally to be recommended.	Very fast to washing both in pale and dark shades. White washed with pale shades is scarcely tinted and with deep shades but slightly.	III.	Acetic acid 50% turns the shade slightly bluer.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shades appear brighter after rinsing.	III.	Not fast to chlorine.	May be used for shading dyeings which are to be developed or coupled.	*Being the first representative of the series of direct dyeing greens, Diamine Green has attained to great importance. Diamine Green G differs from B not only in shade but also in its property of yielding dyeings faster to milling when treated with chromium fluoride.* *Whilst in dyeing Diamine Green B the quantity of soda has to be restricted to the lowest possible limit, Diamine Green G may at will be dyed either with or without soda.*
			Same as with Diamine Green B. The shades dyed with Diamine Green G can also be fixed fast to washing with either chromium fluoride or chrome alum.	
Same as with Diamine Green B.	III.	Not fast to chlorine.	Same as with Diamine Green B.	*Diamine Dark Green N is not quite so bright as Diamine Green B, but it yields very full shades and is therefore specially well suited for dark dyeings.*
The shade appears somewhat brighter after rinsing.	II.	Not fast to chlorine.	Very well suited for dyeings which are to be developed.	*Is not only used for greys and bluish greys which are excellent in point of fastness to washing, but also for bottoming cotton goods which are to be subsequently topped with Indigo, Aniline black or basic dyestuffs.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light	Fastness to Acids
Diamine Black B O pat. 1 % 3 % 	Same as with Diamine Black RO.	Same as with Diamine Black RO.	III.	Same as with Diamine Black RO.
Diamine Black B H pat. 1 % 3 % 	Normal, as indicated on page 7.	Approximately the same as with Diamine Black RO, but not quite so good.	II—III.	Same as with Diamine Black RO.
Diamine Black H W pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Black BH.	III.	Same as with Diamine Black RO.
Diamine Blue Black E pat. 1 %  3 % 	Normal, as indicated on page 7.	Same as with Diamine Black BH.	II.	The change effected by acetic acid 50 % or dilute hydrochloric acid, viz: a slight reddening of the shade, is hardly perceptible.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Black RO.	II.	Not fast to chlorine.	Same as with Diamine Black RO.	*Is used for similar purposes as Diamine Black RO which it fully resembles in its properties.* *Diamine Black BO is brighter and bluer in shade than Diamine Black RO.*
Same as with Diamine Black RO.	III.	Not fast to chlorine.	Same as with Diamine Black RO.	*Diamine Black BH is one of the most important Diamine Colours, being in very great demand both for direct and also for developed shades.* *It is remarkable for the excellent fastness to washing of its direct dyeings and also for its splendid levelling and penetrating property.* *There are but few dyestuffs which are equal to Diamine Black BH for use in dyeing machines or for shading in hot dye-liquors.*
Same as with Diamine Black RO.	IV.	Not fast to chlorine.	Does not come into consideration for aftertreatment.	*The distinguishing feature of Diamine Black HW from the rest of the direct Diamine Blacks is its greenish cast and nearly absolute fastness to hot pressing.*
Same as with Diamine Black RO.	II—III.	Not fast to chlorine.	Same as with Diamine Black RO.	*Is the bluest brand of the Diamine Black group, and ranges in shade between Diamine Black and Diamine Blue.* *Besides for direct shades, its chief application is for developed blues.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Diamine Blue Black R pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Blue BX.	I—II.
Diamine Dark Blue B pat. 1 % 3 % 	Normal, as indicated on page 7.	Same as with Diamine Black BH, or rather better.	III.
Diamine Jet Black OO pat. 1 % 5 % 		Same as with Diamine Black BH.	
Diamine Jet Black SS pat. 1 % 5 % 		The fastness to washing is good both in pale and dark shades. White, washed with pale shades, is not stained and only slightly tinted with dark shades.	
Diamine Jet Black Cr pat. 1 % 5 % 			
Diamine Jet Black RB pat. 1 % 5 % 			

Fastness to Acids	Fastness to Stoving.	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Same as with Diamine Blue Black E.	After rinsing the shade remains unaltered.	II.	Not fast to chlorine.	Does not come into consideration for aftertreatment.	*Diamine Blue Black R yields shades similar to Diamine Blue BX, only somewhat deeper and fuller; the colour may therefore be used with advantage for dyeing dark blues at a low cost.*
Scarcely changed by either acetic acid 50°/₀ or dilute hydrochloric acid.	The shade is somewhat purer and bluer after rinsing.	In pale shades III –IV. In dark shades IV.	Not fast to chlorine.	By a treatment with either bichromate of potash or sulphate of copper; or both together, the dyeings are rendered fast to washing. The aftertreatment with sulphate of copper also enhances the fastness to light.	*Belongs like Diamine Black BH to the most important dyestuffs for saddening purposes, possessing however the advantage over BH of yielding dyeings faster to light and hot pressing. It is largely used in the yarn and piece dyeing trade for producing mode shades as well as for greys and blackish blue shades.*
Acetic acid 50°/₀ and dilute hydrochloric acid turn the shade slightly bluer.		In pale shades I–II. In dark shades III.		With these four dyestuffs, only the treatment with bichromate of potash comes into consideration, yielding dyeings very fast to milling. By coupling with Nitrazol, dark browns are obtained of excellent resistance to washing and acids.	*Chemically, these four dyestuffs- and also the afore- mentioned Diamine Dark Blue B- belong to the same homogeneous group, distinguished by an excellent fastness to light and unsurpassed in this respect by any other direct black.* *Their principal application is for dyeing velveteens, sewing cottons, linen threads and also mercerised linings.* *In pale shades they are besides suitable for the production of slates and bluish greys fast to light.* *Their property of becoming fixed fast to washing by being treated after dyeing with bichromate of potash, renders these colours serviceable for dyeing loose cotton and warps fast to milling and cross-dyeing.* *Diamine Jet Black OO yields deeper and blacker shades than Diamine Dark Blue B.* *Jet blacks may be dyed with Diamine Jet Black SS, Cr and RB; the latter dyeing somewhat redder than Cr, these two dyestuffs are frequently used in combination with each other. Diamine Jet Black Cr differs from SS by its greater solubility.*
Same as with Diamine Jet Black OO.		In pale shades II—III. In dark shades IV.			
Same as with Diamine Dark Blue B.		In pale shades II—III. In dark shades IV.			
Same as with Diamine Dark Blue B.		In pale shades II. In dark shades III—IV.			

Name of the Colour	Method of Dyeing	Fastness to Washing.	Fastness to Light
Oxy Diamine Black N pat. 1 % ■ 5 % ■	Same as with Diamine Black RO.	Both pale and dark shades produced with these dyestuffs are of a good fastness to washing. White, washed with pale shades, is not stained and tinted only very little by dark shades.	II.
Oxy Diamine Black NF pat. 1 % ■ 5 % ■	Normal, as indicated on page 7.		II—III.
Oxy Diamine Black NR pat. 1 % ■ 5 % ■			
Oxy Diamine Black BG pat. 1 % ■ 5 % ■			
Oxy Diamine Black W pat. 1 % ■ 5 % ■			
Oxy Diamine Black BZ pat.* 1 % ■ 5 % ■			
Oxy Diamine Black SOOO pat. 1 % ■ 5 % ■			
Oxy Diamine Black BM pat. 1 % ■ 5 % ■			

* Another brand resembling Oxy Diamine Black BZ very closely — also in shade — is Oxydiamine Black B.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50°/₀ and also dilute hydrochloric acid turn the shade but slightly bluer.	After rinsing the shade appears a trifle bluer.	In pale shades II. In dark shades III—IV.	Not fast to chlorine.		*On account of its great tinctorial power, Oxy Diamine Black N is more suited for the production of deep blacks than for pale and medium shades. It is extensively used in dyeing velveteens and cotton hanks.*
		In pale shades II. In dark shades III.			
		In pale shades II. In dark shades III.		A treatment with bichromate of potash improves their fastness to milling, although this effect is not quite so prominent as when applied to the Diamine Jet Black series. By coupling N NF NR BM SOOO with Nitrazol, dark browns fast to milling are obtained, and blacks fast to milling with B BZ and BG.	
		In pale shades II—III. In dark shades IV.			*The dyestuffs of the NF series of Oxy Diamine Blacks are cheap direct dyeing blacks somewhat inferior to the Diamine Jet Blacks in point of fastness to light, but still sufficient in this respect for very exacting demands.* *There is very little difference in point of fastness between the individual brands, NF may however be considered the fastest to washing of this series.* *Oxy Diamine Black SOOO is by far the brightest and tinctorially the strongest, and surpasses the rest of the direct dyeing blacks by its body of colour.* *Oxy Diamine Blacks B, BZ, BM and NR stand nearest to Oxy Diamine Black SOOO; B and BZ yield more bluish and BM more reddish blacks.* *Oxy Diamine Blacks BG and W are the greenish black representatives of this group.*
		In pale shades II—III. In dark shades IV.			
		In pale shades III. In dark shades IV.			
		In pale shades II. In dark shades IV.			
		In pale shades II—III. In dark shades IV.			

Name of the Colour	Method of Dyeing	Fastness to washing	Fastness to Light
Oxy Diamine Black A pat. 1% ■ 5% ■	Normal, as indicated on page 7.	In point of fastness to washing, these brands behave like the preceding NF group of Oxy Diamine Blacks. There is hardly any individual difference between them in fastness to washing.	I—II.
Oxy Diamine Black SA pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black D pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black AM pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black AT pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black AFF pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black FFC pat. 1% ■ 5% ■			I—II.
Oxy Diamine Black RR pat. 1% ■ 5% ■			I.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50 % or dilute hydrochloric acid turn the shade but a trifle bluer.	After rinsing the shade appears a trifle redder.	In pale shades II. In dark shades III—IV.	Not fast to chlorine.	The aftertreatment with bichromate of potash is less effective than with the preceding Oxy Diamine Black NF group. When treated with Nitrazol after dyeing, SA and RR yield dark browns, whereas the rest of this group yield blacks fast to milling.	*The consumption of dyestuffs of the cheap Oxy Diamine Black group has recently grown quite extraordinarily.* *They are employed in enormous quantities as a substitute for logwood in the dyeing of loose cotton, yarns, knitted and hosiery goods.* *There is no perceptible difference in the fastness of the individual brands.* *Oxy Diamine Blacks A and FFC yield the bluest black; similar in shade and a little faster to acids is SA; D, AT and AFF yield full bodied jet blacks, AM brownish blacks, whilst RR is the reddest representative of this group.* *Oxy Diamine Black A, D, AM and FFC are also good coupling colours which are used for producing low-priced blacks fast to milling when coupled with 2—3 % Nitrazol and an addition of a little New Methylene Blue.* *Oxy Diamine Black RR is frequently used in the dyeing of stockings, being topped for this purpose with New Methylene Blue.*
	After rinsing the shade appears a trifle bluer.	In pale shades II. In dark shades IV.			
	Same as with Oxy Diamine Black SA.	In pale shades II—III. In dark shades III—IV.			
	Same as with Oxy Diamine Black A.	In pale shades II. In dark shades III—IV.			
	The shade is unchanged after rinsing.	In pale shades II. In dark shades III—IV.			
	Same as with Oxy Diamine Black A.	In pale shades II—III. In dark shades III—IV.			
	Same as with Oxy Diamine Black A.	In pale shades II—III. In dark shades III—IV.			
	Not fast to stoving.	In pale shades II. In dark shades III—IV.			

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Oxy Diamine Black JEI pat. 1 % ■ 5 % ■	Normal, as indicated on page 7.	The fastness to washing equals that of the Oxy Diamine Black A series.	II.
Oxy Diamine Black JB pat. 1 % ■ 5 % ■			
Oxy Diamine Black JW pat. 1 % ■ 5 % ■			
Oxy Diamine Black UI pat. 1 % ■ 5 % ■	Normal, as indicated on page 7.	Better in point of fastness to washing than the Oxy Diamine Black A group.	I—II.
Diaminogene extra pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	The fastness to washing of pale shades is good. For dyeing deep shades direct, this dyestuff does not come into consideration.	III—IV.
Diaminogene B pat. 1 % ■ 3 % ■	Normal, as indicated on page 7.	Same as with Diaminogene extra.	III.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50% and dilute hydrochloric acid slightly redden the shade.	Not fast to stoving.	In pale shades II. In dark shades III—IV.	Not fast to chlorine.	Coupled with Nitrazol, these three dyestuffs yield blacks fast to milling.	*Like the preceding blacks, these three dyestuffs belong to the series of cheap direct dyeing blacks and enjoy a similarly extensive application.* *They have, however, the advantage over the preceding blacks that on exposure to light they fade more towards grey, for which reason they must be considered faster to light than the others.* *The members of the J series show very little inclination to bronze, even in full shades; they yield deep, full blacks on both linen yarn and linen piece goods, and are therefore of special importance for the linen and hemp trade.* *A further brand is Oxy Diamine Black JE, which dyes a somewhat greener shade than JEI.*
		In pale shades II—III. In dark shades III—IV.			
		In pale shades III. In dark shades III–IV.			
Very good.	Very fast to stoving.	In pale shades II. In dark shades III—IV.	Not fast to chlorine.	Treating with Nitrazol or developing with Phenylene Diamine render the shade deeper and considerably faster to washing.	*Oxy Diamine Black UI is a member of a new group of Oxy Diamine Blacks which in addition to being excellently fast to washing are distinguished by a specially good resistance to acids.* *Its dyeings stand cross-dyeing in an acid bath without altering their shade, and the wool becomes only slightly stained.*
Acetic acid 50% and dilute hydrochloric acid turn the shade lightly bluer.	The shade is unchanged after rinsing.	IV.	Not fast to chlorine.	Very important for diazotising and developing.	*These two colours are only of importance for direct dyeing in as far as they are used for the shading of fancy colours.* *Their excellent fastness to light and hot pressing deserves to be mentioned.*
Same as with Diaminogene extra, the shade only turning somewhat redder.		III—IV.			

II.

The Aftertreatment of Diamine Colours with Metallic Salts

including a tabular survey of the properties and fastness of dyeings obtained by this process.

Regarding the classification into degrees of fastness, "IV" denotes the highest and "I" the lowest standard. Thus, "IV" indicates a fastness to light corresponding with that of Indigo, whilst the fastness of Congo Red is expressed by "I".

The Production of Dyeings treated with Metallic Salts.

Owing to the fact that the resistance to light of dyeings produced with Diamine Colours may be considerably enhanced by a treatment with metallic salts and this process being exceedingly simple in its application, it has been steadily gaining in importance for the various industries.

The objection is sometimes raised that this aftertreatment renders it difficult to match the shades exactly; the difficulty in this respect is, however, but trifling and is soon overcome with a little practice. Although the shade undergoes a change, the alteration is but slight, and, as it never varies, the extent of the change can easily be determined beforehand by a preliminary trial on a small scale; exact matches may therefore safely be made before the aftertreatment takes place.

Metallic salts do not interfere with the shading; goods aftertreated with metallic salts may be shaded at will by first rinsing them thoroughly and topping with suitable Diamine Colours in a fresh bath containing 2—3 % soda. It is in such case unnecessary to repeat the aftertreatment.

The supposition frequently adopted that the aftertreatment with sulphate of copper is of limited effect only and becomes neutralised by the usual washing process, is an entirely erroneous one. This idea is probably based on the behaviour of some of the earlier colours recommended for aftertreatment, colours which were sensitive to alkalis and the shade of which was changed entirely by the washing process; most of the colours mentioned below do not however show this defect in any way.

We have studied this question very minutely and have found that even if goods are washed with the addition of caustic soda lye, the effect of the aftertreatment with sulphate of copper is not entirely neutralised but is only slightly diminished, whereas ordinary washing with soap has hardly any detrimental effect.

The effect of the aftertreatment with sulphate of copper is neutralised in the first instance by sulphuric acid and also by oxalic acid; whilst acetic acid impairs the fastness of the dyeings very little. The alkaline finishes only reduce the fastness to light of dyeings treated with sulphate of copper, whereas the ordinary finishes rather enhance their resistance in this respect.

The usual methods of aftertreatment are thefollowing:

1) Aftertreatment with cupric salts
2) „ „ bichromate of potash and sulphate of copper.
3) „ „ bichromate of potash, chrome-alum or chromium fluoride.

Aftertreatment with Cupric Salts.

Sulphate of copper is the agent most generally utilised in this case. According to the depth of the shade, 1—3 % are used (reckoned on the weight of the goods), and added along with 1—3% acetic acid to the bath for aftertreatment.

The treatment with sulphate of copper in the first place increases the fastness to light and simultaneously improves the resistance to washing.

The aftertreatment is generally carried out in a hot liquor; the latter may, however, equally well be merely lukewarm, or even cold, if it is to increase the fastness to light only.

Cupric oxide of ammonia may replace sulphate of copper with advantage, it has the same effect and in some cases affects the shade but very little; the application of sulphate of copper is however more convenient and cheaper. Of cupric oxide of ammonia, 1—2 % should be taken, calculated on the weight of the cotton.

Aftertreatment with Bichromate of Potash and Sulphate of Copper.

According to the depth of the shade,

1 % bichromate of potash		2 % bichromate of potash
1 % sulphate of copper	or	2 % sulphate of copper
1 % acetic acid		2 % acetic acid

should be taken.

The effect of this aftertreatment with reference to resistance to light is the same as with sulphate of copper alone; with regard to fastness to washing, a combination of sulphate of copper and bichromate of potash has a more favourable effect.

The aftertreatment is carried out in a boiling bath.

Aftertreatment with Bichromate of Potash, Chrome-Alum or Chromium Fluoride.

According to the depth of shade,

2—3 % of the above mentioned salts and
2—3 % acetic acid

should be used.

These salts are applied in a boiling bath and render some colours considerably faster to washing; the fastness to light is however not affected thereby.

In place of bichromate of potash, bichromate of soda may be used.

Note:

Care should be taken that the baths for aftertreatment remain perfectly clear and that they react rather acid than alkaline; an addition of acetic acid is absolutely necessary in order to correct any alkalinity in the water or in the goods.

The spent liquors are only partly exhausted and can be used repeatedly when suitably replenished, in which case only one half of the original quantities of metallic salts need be added.

The dyestuffs enumerated in the following list can be aftertreated as indicated below:

With sulphate of copper or a mixture of sulphate of copper and bichromate of potash.	With bichromate of potash or bichromate of soda.	With chromium fluoride or chrome-alum.
Diamine Sky Blue F F	Diamine Dark Blue B	Diamine Yellow N
Diamine Blue R W	Diamine Brown B	Diamine Fast Red F
Diamine Brilliant Blue G	Diamine Brown M	Diamine Bronze G
Diamine New Blue R	Diamine Brown R	Diamine Green G
Diamine Blue 3 R	Diamine Brown S	Diamine Brown B
Diamineral Blue R	Diamine Catechine B	Diamine Brown M
Diamine Deep Blue R	Diamine Catechine G	Diamine Brown R
Diamineral Black B	Diamine Catechine 3 G	Diamine Brown S
Diamineral Black 3 B	Diamine Jet Black S S	Diamine Catechine B
Diamineral Black 6 B	Diamine Jet Black C r	Diamine Catechine G
Diamine Dark Blue B	Diamine Jet Black 0 0	Diamine Catechine 3 G
Diamine Brown M	Diamine Jet Black R B	Diamine Dark Blue B
Diamine Brown B		Diamine Jet Black S S
Diamine Brown 3 G		Diamine Jet Black C r
Diamine Catechine B		Diamine Jet Black 0 0
Diamine Catechine G		Diamine Jet Black R B.
Diamine Catechine 3 G		
Diamineral Brown G		
Diamine Orange B		

The following Diamine Colours may also be used for shading dyeings aftertreated with either sulphate of copper or a mixture of sulphate of copper and bichromate of potash:

Diamine Fast Blue C
Diamine Fast Blue C G
Diamine Blue C 4 B
Oxy Diamine Blue G
Oxy Diamine Blue 3 R
Thioflavine S
Oxy Diamine Yellow G G
Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Fast Yellow F F
Diamine Yellow C P
Diamine Orange G
Diamine Orange D
Diamine Brown S
Diamine Brown R
Diamine Bordeaux S
Diaminogene extra.

Dyeings aftertreated with either bichromate of potash or chromium fluoride may on the other hand be brought to shade with any of the Diamine Colours.

Besides the ordinary copper and chrome salts, the following metallic salts act as fixing agents on Diamine Colours:

Salts of Nickel and Cobalt

behave in a manner similar to copper salts principally towards those Diamine Colours which are improved in their fastness to light by an application of sulphate of copper. The resulting fastness to light is however not quite so good as in the case of the copper salts, but the change in shade is less marked. They do not therefore offer any special advantage over copper salts and for this reason are but little used. For an aftertreatment with these salts, 3 % acetate of nickel or 3 % acetate of cobalt should be employed.

Salts of Alumina (acetate of aluminia or alum)

improve the fastness of all dyeings against washing and steaming; they furthermore enhance the resistance of the dyeings against water. The aftertreatment with alum consists in the goods being immersed for 10 or 20 minutes in a cold or lukewarm bath containing 8 oz of alum per 10 gallons of water. If acetate of alumina, which is more effective than alum, is used, 5 pints of acetate of alumina 4 1/2 ° Tw. per 10 gallons liquor should be added.

Salts of Iron (acetate of iron)

act similarly to alumina salts, but are not so efficacious in their resistance to water. As a rule, pyrolignite of iron of 3—4 1/2 ° Tw. is employed, and the goods treated for a few minutes either in a cold or lukewarm solution of this fixing agent.

Sumac and Iron.

Dark shades, and particularly blacks, are frequently passed finally through a bath of sumac and iron, which process not only increases the fastness of the dyeings to washing, but also effects an increase in the weight of the cotton up to 10 %. The goods are left for 1 to 2 hours in a cold or lukewarm bath with 10—15 % extract of sumac and are subsequently saddened in a bath of pyrolignite of iron of 2—4 $^1/_2$ ° Tw. After frequent turning in this bath, the goods are lifted, rinsed and dried.

Thiosulphate of Soda.

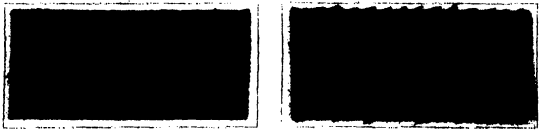
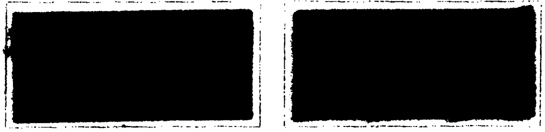
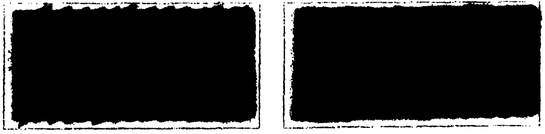
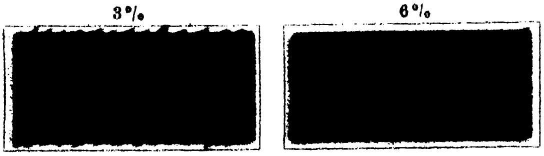
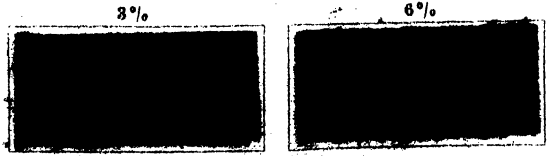
By impregnating the dyeings with solutions of thiosulphate of soda (1:10), most of the Diamine Colours gain in fastness to light, especially in the case of pale shades. As however this effect is neutralised by subsequent washing, this method has not gained any importance.

It may here be mentioned that all finishing pastes very considerably increase the resistance to light of all dyeings, a fact which applies not only to starch finishes, but also to those prepared with burnt starch (dextrine) or treacle.

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Diamine Sky Blue FF pat. aftertreated with *sulphate of copper* 1°/o 3°/o	For direct shade see page 44, for after-treatment page 66.	The fastness to washing is considerably better than that of direct dyeings, and white washed at the same time is less tinted. Alkaline washing turns the shade bluer.	IV.
Diamine Blue RW pat. aftertreated with *sulphate of copper* 1°/o 3°/o	For direct shade see page 40, for after-treatment page 66.	The fastness to washing is the same as with Diamine Sky Blue FF aftertreated. With regard to staining white, Diamine Blue RW is considerably better, pale or medium shades washed with white stain the latter only very slightly.	IV.
Diamine Brilliant Blue G pat. aftertreated with *sulphate of copper* 1°/o 3°/o	For direct shade see page 42, for after-treatment page 66.	The shades resist washing with soap very well; washing with soda renders them more plummy. As regards bleeding into white washed along with them, the aftertreated dyeings are superior to the direct ones.	IV.
Diamine New Blue R pat. aftertreated with *sulphate of copper* 1°/o 3°/o	For direct shade see page 44, for after-treatment page 66.		
Diamine Blue 3R pat. aftertreated with *sulphate of copper* 1°/o 3°/o	For direct shade see page 38, for after-treatment page 66.	Same as with Diamine Brilliant Blue G. The shade turns somewhat redder on washing with soda.	III—IV.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50°/₀ does not alter the shade, dilute hydrochloric acid turns it somewhat bluer.	The shade is somewhat clearer after subsequent rinsing.	III—IV.	Not fast to chloring.	The same result may be obtained with a combination of sulphate of copper and bichromate of potash. The shade be[illegible] li[illegible] resulting fastness to washing is better than with sulphate of copper by itself.	*Aftertreated with sulphate of copper, [illegible] two dy[illegible]ensively used both for pale blues [illegible] for greens (in combination with Diamine Fast Yellow).*
Acetic acid 50°/₀ and also dilute hydrochloric acid slightly redden the shade.	Same as with Diamine Sky Blue FF.	III—IV.	Not fast to chloring.	Same as Diamine Sky Blue FF.	*Besides being used for cotton yarns and piece goods, they are also extensively applied on linen.* *The shades retain their excellent fastness to light even after repeated washings.*
Acetic acid 50°/₀ and also dilute hydrochloric acid make the shade a little brighter.	Not fast to stoving.	III—IV.	Withstands fairly well a weak chloride of lime solution for a few minutes.	Same as Diamine Sky Blue FF.	*Diamine Brilliant Blue G behaves similarly to Diamine Sky Blue FF and is useful for dyeing navies fast to light.*
Acetic acid 50°/₀ hardly effects a change, hydrochloric acid renders the shade a little brighter.	The shade is somewhat purer after subsequent rinsing.	III.	Not fast to chloring.		*Same as with Diamine Brilliant Blue G, but fuller and dyeing a deeper shade.*
Hardly changed by acetic acid 50°/₀. Dilute hydrochloric acid turns the shade slightly bluer.	Not fast to stoving.	III.	Not fast to chloring.	Same as Diamine Sky Blue FF.	*The aftertreatment with sulphate of copper renders the shade more plummy. The product is not only used for dyeing reddish blues, but also for shading blue and brown dyes which may be subjected to an aftertreatment.*

Dyeings aftertreated

Name of the Colour	Method of Dyeing	Fastness to washing	Fastness to Light
Diamineral Blue R pat. aftertreated with *sulphate of copper* 1 % 3 % 	For direct shade see page 45, for after-treatment pages 66 and 67.	Are superior to the other blues which can be aftertreated, because the shades are but little changed when washed with soda; white cotton washed with them is only slightly tinted.	IV.
Diamine Deep Blue R pat. aftertreated with *sulphate of copper* 1 % 3 % 			
Diamineral Black B pat. aftertreated with *sulphate of copper and bichromate of potash* 3 % 5 % 	Normal for direct shades, as indicated on page 7; for after-treatment see pages 66 and 67.	The fastness to washing is very good, and white washed with them is tinted very little. Diamineral Black B is in this respect the best, 6 B bleeding somewhat, and 3 B standing between the two.	IV.
Diamineral Black 3 B pat. aftertreated with *sulphate of copper and bichromate of potash* 3 % 6 % 			
Diamineral Black 6 B pat. aftertreated with *sulphate of copper and bichromate of potash* 3 % 6 % 			

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50 °/₀ leaves the shade unchanged; dilute hydrochloric acid renders it slightly plummy.	The shade turns a trifle clearer.	III—IV.	Not fast to chloring.	**By a treatment with a combination of sulphate of copper and bichromate of potash, the shade is slightly flattened, but the fastness to washing is still further improved.**	*Diamineral Blue R and Diamine Deep Blue R are amongst the best dyestuffs available for aftertreatment, as they do not change their shade even when subjected to severe washing. They are extensively used both in yarn and piece dyeing.* *The dyeings treated with sulphate of copper are frequently topped with basic colours such as Naphtindone and New Methylene Blue.*
	Unchanged after subsequent rinsing.				
Acetic acid 50 °/₀ and also dilute hydrochloric acid turn the shade slightly bluer.	The shade appears somewhat bluer after subsequent rinsing.	III—IV.	Not fast to chloring.	The treatment with sulphate of copper alone has the same effect as its combination with bichromate of potash, whilst the action of the latter by itself is insufficient.	*When aftertreated, the dyeings of Diamineral Black possess excellent fastness to light, milling and acids; interwoven with woollen yarn, they also resist boiling with bichromate of potash and sulphuric acid, the preparatory process to black-dyeing with logwood.* *These dyestuffs are further specially used as a bottom for Aniline Black, particularly 3 B and 6 B dyed direct; the aftertreatment takes place simultaneously with the dyeing of Aniline Black.* *Whereas Diamineral Black B yields a full deep black, both 3 B and 6 B yield very fine blue blacks which can be easily turned into jet black by shading with Diamine Fast Yellow B.* *Diamineral Black 3 B and 6 B aftertreated with sulphate of copper are extensively employed for dyeing mercerised yarns and piece goods.*
		III—IV.			
		IV.			

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Diamine Dark Blue B pat. aftertreated with *sulphate of copper* 1 % ■ 3 % ■	For direct shade see page 54, for aftertreatment pages 66 and 67.	The dyeings are excellent in point of fastness to washing and not bleeding.	IV.
Diamine Jet Black O O pat. aftertreated with *bichromate of potash* 1 % ■ 5 % ■	For direct shade see page 54, for aftertreatment page 67.	The fastness to washing is more or less dependent on the quantity of bichromate of potash employed. Heavy shades aftertreated with 3 % bichromate of potash are very fast to washing and bleed scarcely at all into white washed with them.	III.
Diamine Jet Black S S pat. aftertreated with *bichromate of potash* 1 % ■ 5 % ■			
Diamine Jet Black Cr pat. aftertreated with *bichromate of potash* 1 % ■ 5 % ■			
Diamine Jet Black RB pat. aftertreated with *bichromate of potash* 1 % ■ 5 % ■			

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
The shade is not altered by either acetic acid 50 °/₀ or dilute hydrochloric acid.	The shade is somewhat bluer after subsequent rinsing.	III—IV.	Not fast to chloring.	The combination of bichromate of potash and sulphate of copper gives the same result as the latter by itself. Bichromate of potash used alone merely improves the fastness to washing.	*Diamine Dark Blue B, aftertreated with sulphate of copper, yields shades similar to Diamineral Blue R and deserves the preference for dyeing goods required to be fast to washing, being faster in this respect than any of the other blues available for aftertreatment. Diamine Dark Blue B is used both for dark blues and for shading products of the Diamine Jet Black group. In the latter case, only the aftertreatment with bichromate of potash is important.*
Acetic acid 50 °/₀ as also hydrochloric acid turn the shade slightly bluer.	The shade is somewhat bluer after subsequent rinsing.	II—III.	Not fast to chloring.	Only an after-treatment with bichromate of potash is suitable for these four blacks, sulphate of copper reddening the shade too much. Chrome alum may be used in place of bichromate of potash, and, though not quite so good in its effect, renders the shades somewhat brighter.	*The aftertreated dyeings of Diamine Jet Blacks are principally used for dyeing warps for unions fast to milling, also for sewing threads and for cotton piece goods.* *Diamine Jet Black Cr, shaded with Diamine Blue and aftertreated with chrome alum, has proved very useful and has been much adopted for the dyeing of mercerised piece goods.* *Diamine Jet Black RB is the deepest brand of this series; Diamine Jet Black Cr and SS are nearly alike in shade. Diamine Jet Black Cr exhausts a little more slowly, whilst the shades of SS are somewhat faster to both milling and acids.*
	Very good.	III.			
		III.			
		II - III.			

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Diamine Brown M pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■	For direct shades see pages 22 to 24; for after-treatment pages 66 and 67.	Very good. Washing with either soap or soda does not affect the shade. White cotton is not stained at all or only very slightly.	III.
Diamine Brown B pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■			
Diamine Catechine G pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■			
Diamine Catechine B pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■			III.
Diamine Catechine 3G pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■			IV.
Diamineral Brown G pat. aftertreated with *sulphate of copper and bichromate of potash* 1 % ■ 3 % ■	For direct shade see page 25, for after-treatment pages 66 and 67.	Stands washing very well with both soap and soda. White washed with dark shades is stained but slightly.	IV.

with Metallic Salts.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Acetic acid 50% renders the shade more plummy.	The shade appears a little duller after subsequent rinsing.	II.	Not fast to chloring.	Sulphate of copper has on all these dyestuffs a similar but not quite so satisfactory an effect as in combination with bichromate of potash. The effect obtained with bichromate of potash by itself is also somewhat inferior.	*Diamine Brown M and B and the Diamine Catechines are the most important brown dyestuffs available for aftertreatment, as by their aid the whole range of the ordinary brown shades can be dyed fast to washing and light.* *Diamine Catechine B is better soluble than Diamine Brown B, the latter is however somewhat better in point of fastness to milling.* *Diamine Catechine 3 G, having a rich yellow cast, may be used not only for dyeing yellowish cutch shades, but also for the production of mode shades.*
Similar as Diamine Brown M.	Not fast to stoving.	II—III.			
Acetic acid 50% or dilute hydrochloric acid turn the shade somewhat duller.	The shade is somewhat bluer after subsequent rinsing.	III—IV.			
Same as Diamine Catechine G.	Same as Diamine Catechine G.	III—IV.			
Acetic acid and dilute hydrochloric acid turn the shade duller and blackish.	Not sufficiently fast to stoving.	II—III.			
Same as Diamine Catechine 3 G.	Same as Diamine Catechine 3 G.	II.	Not fast to chloring.	Sulphate of copper by itself has a similar effect as a combination of sulphate of copper and bichromate of potash.	*Diamineral Brown G is equal in fastness to Diamine Catechine 3 G, but redder in shade. It may be used in combination with the various Diamine Browns and Diamine Catechines.*

Name of the Colour	Method of Dyeing	Fastness to Washing	Fastness to Light
Diamine Orange B aftertreated with *sulphate of copper* 1 % ■ 3 % ■	For direct shades see pages 16 and 20, for after-treatment page 66.	Very fast to washing with both soap and soda. White washed with deep shades is but slightly tinted.	IV.
Diamine Brown 3 G pat. aftertreated with *sulphate of copper* 1 % ■ 3 % ■			
Diamine Fast Red F pat. aftertreated with *chromium fluoride.* 1 % ■ 3 % ■	For direct shade see page 32, for after-treatment page 67.	Diamine Fast Red F aftertreated does not lose in intensity when washed with soap and soda. White washed with deep shades becomes somewhat stained.	II—III.
Diamine Yellow N pat. aftertreated with *chromium fluoride* 1 % ■ 2 % ■	For direct shade see page 12, for after-treatment page 67.	Similar to Diamine Fast Red F in its behaviour, but not quite so good with regard to not bleeding into white.	IV.
Diamine Green G pat. aftertreated with *chromium fluoride* 1 % ■ 3 % ■	For direct shade see page 50, for after-treatment page 67.	Same as Diamine Yellow N.	II—III.
Diamine Bronze G pat. aftertreated with *chromium fluoride* 1 % ■ 3 % ■	For direct shade see page 24, for after-treatment page 67.	The fastness to washing is very good. Adjacent white is either not stained at all or only slightly.	II—III.

Fastness to Acids	Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Effects of Aftertreatment	Remarks
Both acetic acid 50°/o and dilute hydrochloric acid turn the shade yellower.	Not fast to stoving.	III—IV.	Not fast to chloring.	The effect of sulphate of copper and bichromate of potash in combination is similar to that of the former by itself, whilst bichromate of potash alone does not come into consideration.	*Very well suited for dyeing yellowish browns and for shading purposes.*
Acetic acid 50°/o leaves the shade unchanged; dilute hydrochloric acid turns it slightly yellower.	The shade is somewhat yellower after subsequent rinsing.				*Behaves in a similar manner to Diamine Orange B, but is of considerably deeper shade.*
Not changed by acetic acid 50°/o; dilute hydrochloric acid turns the shade blue.	After rinsing the shade is somewhat clearer.	III.	Not fast to chloring.	Chromium fluoride may be replaced by chrome alum.	*The aftertreatment is resorted to chiefly in order to render the shades faster to milling and acids. The excellent fastness to light of Diamine Fast Red F is only slightly affected by the aftertreatment.*
Acetic acid 50°/o turns the shade somewhat greener.	The shade is slightly redder and purer after subsequent rinsing.	IV.	Resists a weak chloride of lime solution.	Sulphate of copper slightly reddens the shade, but renders it faster to washing.	*When aftertreated, the dyeings are very fast to acids, and Diamine Yellow N is therefore quite suitable for dyeing warps for Union goods fast to cross-dyeing; it may also be used with advantage in shading Diamine Fast Red F.*
Acetic acid 50°/o turns the shade somewhat bluer, dilute hydrochloric acid somewhat duller.	The shade is somewhat bluer after subsequent rinsing.	IV.	Not fast to chloring.	Same as with Diamine Fast Red F.	*May be used for dyeing greens fast to milling.*
Acetic acid 50°/o turns the shade somewhat browner and dilute hydrochloric acid somewhat duller.	The shade is somewhat brighter after subsequent rinsing.	II—III.	Not fast to chloring.	Chrome alum may be used in place of chromium fluoride. Sulphate of copper alone, or in combination with bichromate of potash, also renders the shades fast to milling, but turns them slightly browner.	*Is serviceable for producing olives fast to milling, for which purpose it can be shaded with Diamine Green G and aftertreated with chromium fluoride; it is also useful for shading browns fast to milling if aftertreated with sulphate of copper and bichromate of potash.*

III.

The Production of Diazotised and Developed Shades

with a tabular survey of their properties and fastness.

Regarding the classification into degrees of fastness, "IV" denotes the highest and "I" the lowest standard. Thus, "IV" indicates a fastness to light corresponding with that of Indigo, whilst the fastness of Congo Red is expressed by "I".

The Production of Diazotised and Developed Dyeings.

The fixing of Diamine Colours by diazotising and developing, is, as is well known, one of the processes most frequently applied.

This treatment increases on the one hand the intensity of the shades, rendering them in some cases as heavy again, and on the other hand fixes the colours so well that the developed dyeings may be termed very fast to washing and milling.

The Diamine Colours which may be diazotised and developed are:

Primuline
Diamine Cutch
Diamine Brown M
Diamine Brown S
Diamine Brown V
Cotton Brown A
Cotton Brown N
Diamine Blue 2 B
Diamine Blue 3 B
Diaminogene Blue B B
Diaminogene Blue G
Diaminogene Dark Blue
Diamine Azo Blue 6 B
Diamine Azo Blue 2 R
Diamine Azo Blue R
Diamine Heliotrope G
Diamine Heliotrope B
Diamine Heliotrope O
Diamine Black B H
Diamine Black R O
Diamine Black B O
Diamine Blue Black E
Diamine Azo Black B
Diamine Beta Black B
Diamine Beta Black B B
Diaminogene B
Diaminogene extra
Diaminogene B W
Diaminogene C C L.

The following dyestuffs cannot be developed, but resist the diazotising and developing process without being affected and may therefore be applied for shading dyeings which are ultimately to be developed:

Thioflavine S
Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Fast Yellow FF
Diamine Orange G
Diamine Orange B
Diamine Scarlet B
Diamine Fast Red F
Diamine Bordeaux S
Diamine Violet N
Oxy Diamine Violet B
Diamine Blue 3R
Diamine New Blue R
Diamine Fast Blue C
Diamine Fast Blue CG
Diamine Steel Blue L
Diamine Green B
Diamine Black HW.

Process of Diazotising and Developing.

The following three operations are necessary for producing diazotised and developed dyeings:

1) Dyeing with one of the colours capable of being diazotised in the manner explained below, and rinsing in cold water (whizzing or wringing off after rinsing is hardly necessary).
2) Diazotising for 10 or 15 minutes in cold water containing nitrite of soda and hydrochloric acid, then rinsing in water containing a little hydrochloric acid.
3) Developing for 10 or 15 minutes in cold water containing one or the other of the developers mentioned on pages 89 and 90.

Dyeing. With regard to the dyeing process, nothing need be added to what has already been stated on page 7 in connection with the production of direct shades.

Diazotising. The diazotising always takes place in a cold bath.

For 10 lbs. cotton take for the first bath

$^{1}/_{2}$ lb. nitrite of soda
$^{3}/_{4}$ lb. hydrochloric acid 32° Tw.

or instead of hydrochloric acid, use $^{1}/_{2}$ lb. sulphuric acid 168° Tw.

First dissolve the nitrite in some water and add the solution to the bath, then add the sulphuric or hydrochloric acid.

If the bath has been already used, add 1/3 of the above quantities for every 10 lbs. of cotton.

It is seldom necessary to prepare a stronger diazotising bath than the above. In order to ascertain whether the bath is still active, dip into it a piece of paper impregnated with starch paste and potassium iodide, which should at once turn blue. Further, the presence of the necessary nitrous acid can be detected by its smell. If, however, the odour of the bath is too pungent, it is an indication that too much nitrite is present. An excess of nitrous acid in the diazotising bath is not injurious, but ought to be avoided for economical reasons.

When light shades are to be developed, the quantities given may be still further reduced.

The quantities above stated are, in percentage amounts, as follows:

2 1/2 % nitrite
7 1/2 % hydrochloric acid 32° Tw.
or, 5 % sulphuric acid 168° Tw.
} reckoned on the weight of the goods.

These are calculated for very dark shades.

For light and medium shades, these proportions can be reduced for the first bath to

1 1/2 % nitrite
5 % hydrochloric acid 32° Tw.
or, 3 % sulphuric acid 168° Tw.

For diazotising in dyeing machines, or for diazotising piece goods on the jigger, reduced quantities must also be taken. Details on this subject will be found on subsequent pages where the various classes of goods are dealt with.

The diazotising is best conducted in wooden vessels. When dyeing in machines, the diazotising and developing may also take place in copper vessels.

It is not necessary to whizz or wring off after diazotising. The goods are allowed to drain, are then rinsed slightly in acidulated water (1 pint of hydrochloric acid to about 100 gallons of water), and finally entered immediately into the developing bath.

It is important not to leave the goods in the intermediate stages for too long a time, but to proceed with the rinsing and developing immediately after diazotising. The dyeings should not be exposed either to glaring daylight or to other sources of heat, but the acid rinsing and developing should be proceeded with as rapidly as possible.

Developing. The diazotising and developing operations are always conducted in a cold bath, and the developing bath is charged with the necessary developer, in solution; the goods are turned for a few minutes in this bath, lifted, and rinsed, or soaped as desired. The shade and fastness of the dyeings obtained differ according to the developer employed.

The dissolving of the developers and the preparation of the developing baths will be seen from the following table.

Preparation of Developing Baths.

Beta-Naphtol *)	Naphtylamine Ether powder	Naphtylamine Ether N powder	Blue Developer AN	Fast Blue Developer AD pat.	Resorcine	Phenylene Diamine	Phenol	Bordeaux Developer	Schaeffer's Salt (Betanaphtol-sulphonate of soda)
7 lbs. 3 oz. Beta-Naphtol and 6 lbs. caustic soda 77° Tw. are dissolved in 10 gallons boiling water.	2 lbs. 4 1/2 oz. Naphtylamine Ether powder and 1 lb. 2 oz. hydrochloric acid are dissolved in 10 gallons boiling water.	2 lbs. 4 1/2 oz. Naphtylamine Ether N powder are dissolved in 10 gallons boiling water which contains an addition of 1/2 pint hydrochloric acid 35° Tw.	13 1/2 lbs. Blue Developer AN are mixed with 10 gallons cold water. The mixture is left standing until the frothing has subsided, when it is brought to the boil.	3 lbs. 11 oz. Fast Blue Developer AD are dissolved in 10 gallons boiling water which contains an addition of 2 lbs. 4 oz. hydrochloric acid.	5 1/2 lbs. Resorcine are mixed with 12 lbs. caustic soda 77° Tw. and dissolved in 10 gallons boiling water.	4 1/2 lbs. Phenylene Diamine and 1 1/2 lb. soda ash are dissolved in 10 gallons boiling water.	4 lbs. 11 oz. Phenol are mixed with 12 lbs. caustic soda 77° Tw. and dissolved in 10 gallons boiling water.	2 lbs. 4 1/2 oz. Bordeaux Developer are dissolved in 10 gallons boiling water which contain an addition of 1/2 pint hydrochloric acid 35° Tw.	12 1/2 lbs. Schaeffer's Salt and 7 1/2 lbs. soda ash are dissolved in 10 gallons boiling water.
For every 10 lbs. of Cotton prepare the baths with:									
1 1/2 pint of the above solution.	6 1/2 pints of the above solution.	6 1/2 pints of the above solution.	1 1/2 pint of the above solution.	4 pints of the above solution.	1 1/4 pint of the above solution.	1 1/2 pint of the above solution.	1 1/4 pint of the above solution.	6 1/2 pints of the above solution.	1 1/4 pint of the above solution.

If the baths are intended for repeated use, they are charged for the first two or three lots with the above stated quantities, which may be reduced to 3/4 for all subsequent lots.

If the developing takes place in very dilute baths, i. e. more than 20 times the weight of the cotton, the quantities of the developers must be increased correspondingly.

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*) Alpha-Naphtol is dissolved like Beta-Naphtol and is used in similar quantities.

Developers. Quantities absorbed.

The quantities required of the different developers may be calculated on the following basis:

	For developing a 2% dyeing.	For developing a 4—5% dyeing.
Beta-Naphtol	0.45%	0.9 %
Alpha-Naphtol	0.45%	0.9 %
Naphtylamine Ether powder	0.75%	1.5 %
Naphtylamine Ether N	0.75%	1.5 %
Blue Developer AN	1.00%	2.00%
Fast Blue Developer AD pat.	0.75%	1.5 %
Resorcine	0.35%	0.7 %
Phenylene Diamine	0.35%	0.7 %
Phenol	0.25%	0.5 %
Bordeaux Developer	0.50%	1.00%
Schaeffer's Salt	0.45%	0.9 %

These proportions are to be understood for the first baths; if the developing baths are used repeatedly, the quantities of developers required are reduced by about 25%.

In order to vary the shades of the developed dyeings, some developers may be mixed with others; for instance:

Beta-Naphtol	with	Resorcine
Beta-Naphtol	„	Phenylene Diamine
Phenylene Diamine	„	Resorcine
Naphtylamine Ether	„	Fast Blue Developer AD pat.

Aftertreatment with Soda.

With some Diamine Colours, notably with Diamine Cutch, the usual fixing of the diazotised dyeings by developing may also be replaced by a simple treatment with a solution of soda.

In such a case the diazotising takes place as usual, and the goods are then entered without previous washing into a bath containing

5 oz soda ash per 10 gallons water

at 105—120° F., at which temperature the goods are worked in this bath for $^1/_4$ hour, then lifted, rinsed as usual or soaped.

Treatment of diazotised and developed dyeings.

An addition of sulphate of copper to the diazotising bath somewhat increases the fastness to light in most cases; it is however advisable to allow an aftertreatment with sulphate of copper to follow as a final operation, by passing the goods through a cold or lukewarm bath charged with 3 % sulphate of copper and 3 % acetic acid, and to rinse.

As may be seen from the following tables, the fastness to light of quite a number of developed dyeings is considerably enhanced by this treatment.

Brightening the shade of diazotised dyeings.

Having been developed or aftertreated, the goods are either soaped or lightly oiled.

Topping with basic dyestuffs.

For shading the developed dyeings, topping with basic dyestuffs is most generally resorted to and is carried out in the same manner as with the direct dyeings.

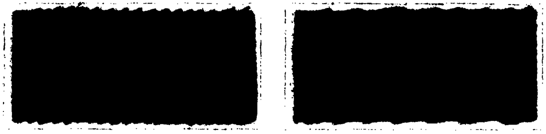
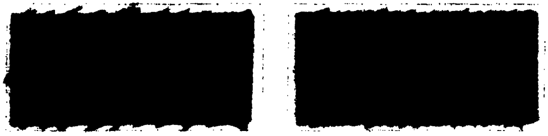
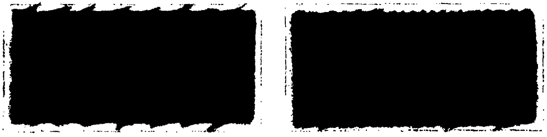
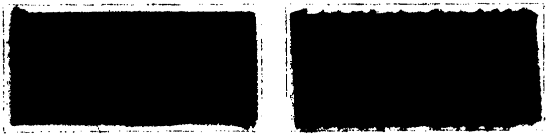
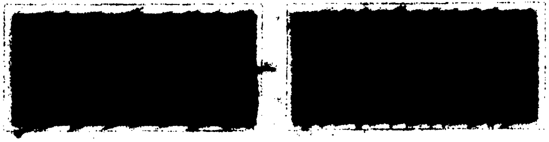
Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Primuline *1) developed with Beta-Naphtol* 4 % ■ 6 % ■	Dyed with 20 to 30 % Glauber's salt or common salt.	Fastness to washing and milling very good. White is not tinted at all or but slightly so.	I.
2) developed with Bordeaux Developer 4 % ■ 6 % ■		Same as if developed with Beta-Naphtol.	I.
3) developed with Phenylene Diamine 4 % ■ 6 % ■		Very good. Bleeds somewhat more than Development 1.	I.
4) developed with Resorcine 4 % ■ 6 % ■		Same as if developed with Phenylene Diamine.	I.
5) developed with Phenol 4 % ■ 6 % ■		Same as if developed with Phenylene Diamine.	III—IV.

Primuline may also be developed with Alpha-Naphtol, which yields a somewhat duller but equally fast red as when fastness to washing, is also to

Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
Very good.	III—IV.	The shade remains unchanged for some time in a 2% solution of chloride of lime, gradually growing paler and disappearing altogether after abt. $^3/_4$ hour's immersion.	Boiled in an acid bath together with white wool, the dyed cotton in pale shades does not stain the wool and in dark shades but very slightly.	Aftertreatment with sulphate of copper renders the shade duller and more claret. The fastness to light is improved and may be termed III.	*Developed Primuline Red is chiefly employed as a red fast to washing and acids for dyeing hanks, cops and warps.* *The claret obtained by an after-treatment with sulphate of copper is a little duller in shade, but very fast to light.*
The shade is unchanged after subsequent rinsing.	III.	Same as if developed with Beta-Naphtol.	Same as, or even better than when developed with Beta-Naphtol.	The shade is changed but little and the fastness to light only slightly improved.	*Being bright and fast to washing, this claret is used for similar purposes as Primuline Red.*
The shade is turned slightly yellower.	III—IV.	Not fast to chloring.	Same as if developed with Beta-Naphtol.	The shade is changed but little. The fastness to light is improved to I—II.	*Developing with these two agents is of less importance than the two preceding processes, as the same shades may be produced by the much more convenient and cheaper coupling process.* *It is only for producing mode shades fast to acids that Primuline in combination with various Diamine Blacks is developed with Resorcine.*
The shade is somewhat redder after subsequent rinsing.	III—IV.	Not fast to chloring.	Similar as if developed with Beta-Naphtol.	The shade is turned from orange to yellowish brown and the fastness to light improved to III—IV.	
The shade is slightly clearer after subsequent rinsing.	IV.	Not fast to chloring.	Stains the wool in an acid bath more than if developed with Beta-Naphtol.	Shade and fastness to light same as of the original dyeing.	*Developing with Phenol serves for producing shades fast to acids in a like manner to the developing with Resorcine.*

developed with Beta-Naphtol; the developing with Schaeffer's salt, yielding the brightest red but with slightly inferior be taken into consideration.

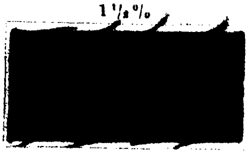
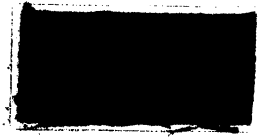
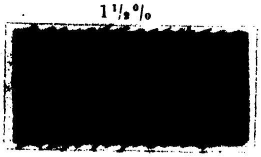
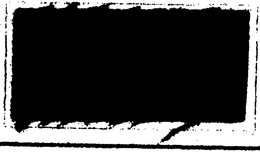
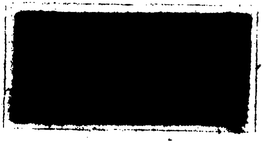
Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diamine Cutch pat. *1) diazotised and developed with soda* 3 % 5 % 	Dyed with 1 % soda and 30 % Glauber's salt.	As fast to washing and milling as Primuline developed with Beta-Naphtol.	II.
2) developed with Fast Blue Developer AD pat. 3 % 5 % 		Not quite so good as if obtained with Development 1.	III.
Diamine Brown M pat. *1) developed with Beta-Naphtol* 3 % 5 % 	For direct dyeing see page 22.	In fastness to washing and milling as good as Primuline Red. Less satisfactory with regard to staining white, which is slightly tinted in severe milling.	I—II.
2) developed with Phenylene Diamine 2 % 3 % 			
Diamine Brown S pat. *1) developed with Beta-Naphtol* 2 % 3 % 	For direct dyeing see page 22.	Same as with Diamine Brown M.	I—II.
2) developed with Phenylene Diamine 2 % 3 % 			

Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
The shade is slightly redder after subsequent rinsing.	III—IV.	Resists very well a few minutes immersion in a chloride of lime solution 2° Tw.	The wool is not tinted by pale shades, but somewhat by dark ones.	Causes no change in shade. The fastness to light improves to III.	*Diamine Catch is applied for dyeing browns fast to washing. The diazotised dyeings when developed with soda are faster to washing than those developed with Fast Blue Developer; the latter are, however, faster to light.*
Same as shade obtained with Development 1.	III—IV.	Not fast to chloring, though it will resist a few minutes immersion in a weak chloride of lime solution.	Not quite so good as shade obtained with Development 1.	Shade and fastness to light slightly changed.	
The shade is somewhat brighter after subsequent rinsing.	I—II.	Not fast to chlorine.	The wool is slightly tinted by light shades, but a little more so by deep shades.	Renders the dyeings developed both with Beta-Naphtol and Phenylene Diamine a little brighter and improves the fastness to light to III—IV.	*These two methods of developing Diamine Brown M are employed for very heavy browns only; it is possible to obtain shades of this kind by dyeing with only 1½—2% Diamine Brown M and developing with either Beta-Naphtol or Phenylene Diamine.* *By an aftertreatment with sulphate of copper the fastness to light is considerably improved.*
The shade is brighter after subsequent rinsing.	II—III.	Not fast to chlorine.	The wool is not stained by pale shades and by dark shades only a little.	The aftertreatment renders the shade plummier in both instances and improves the fastness to light to III—IV.	*Diamine Brown S behaves similarly to Diamine Brown M, but yields more purplish browns.* *Diamine Brown V yields the same shade; Diamine Brown S has, however, the preference for developed shades owing to its better solubility.*

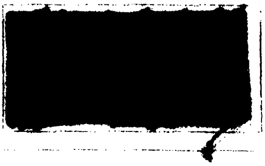
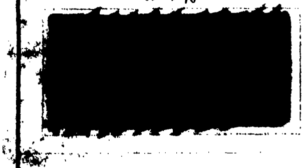
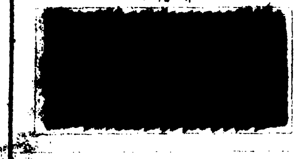
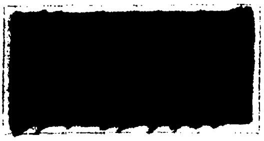
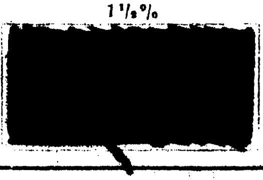
Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Cotton Brown A pat. and **N** pat. *1) developed with Beta-Naphtol* A 3% N 3% *2) developed with Phenylene Diamine* A 3% N 3%	For direct dyeing see page 18.	The dyeings will suffice for moderate demands with regard to fastness to milling, but are not so good as those of Diamine Cutch diazotised and developed with soda.	I—II.
Diamine Blue 2B pat. *1) developed with Beta-Naphtol* 1% 3% *2) developed with Alpha-Naphtol* 1% 3%	For direct dyeing see page 40.	Very good. White cotton is not tinted.	II—III.
Diaminogene Blue BB pat. *developed with Beta-Naphtol* 1½% 3%	Dyed with 1% soda and 20% Glauber's salt.	Very fast to washing and milling. White cotton washed with it is tinted very slightly blue.	III—IV.
Diaminogene Blue G pat. *developed with Beta-Naphtol* 1½% 3%		Behaves exactly like	

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
The shade is somewhat paler after subsequent rinsing.	IV.	The dyeings resist only a weak chloride of lime solution; they turn to a yellower brown after a short immersion in a chloride of lime bath of 3° Tw.	Not sufficiently fast to acids, bleeding considerably on to the wool.	By aftertreatment with sulphate of copper the fastness to light is improved to III—IV, and the shades are turned somewhat duller.	*Developed dyeings of Cotton Brown are in great favour by reason of their fine yellowish brown shades and their bright tone.*
The shade is somewhat more greenish after subsequent rinsing.	III—IV.	Resists a weak chloride of lime solution for 1/2 hour.	The colour tints the wool rather heavily in a boiling acid bath, so that the developed shades of the Diamine Blues do not come into consideration for cross-dyeing.	The shade of dyeings developed with Beta-Naphtol turns somewhat redder, that of dyeings developed with Alpha-Naphtol more greyish. The fastness to light of both is improved to IV.	*Similar greys with an equal fastness to washing and light can also be obtained with Diamine Blue 3 B and Diamine Sky Blue developed with either Beta-Naphtol or Alpha-Naphtol.*
The shade becomes brighter.	III—IV.	Not fast to chloring.	Does not alter in shade when boiled in an acid bath, but stains white wool somewhat.	The shade becomes slightly duller and greener. The fastness to light increases to IV.	*Diaminogene Blue BB is one of the most important blue dyestuffs for developing purposes, whereas Diaminogene Blue G has not attained to this distinction.* *Either as a self colour or shaded with Diamine Azo Blue, Diaminogene Blue BB is most extensively used for dyeing standard Indigo shades on loose cotton, cops, hanks, hosiery and also on piece goods.*
Diaminogene Blue BB.					

Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diaminogene Dark Blue pat. *developed with Beta-Naphtol* 1½% 3% 	Same as with Diaminogene Blue BB.	Same as with Diaminogene Blue BB.	III.
Diamine Azo Blue 6 B pat. *developed with Beta-Naphtol* 1½%  3% 	Same as with Diaminogene Blue BB.	Same as with Diaminogene Blue BB.	II—III.
Diamine Azo Blue R pat. *1) developed with Beta-Naphtol* 1½%  3% 	For direct dyeing see page 40.	Same as with Diaminogene Blue BB.	II—III.
2) developed with Naphtylamine Ether N 1½% 3% 		Same as with Diaminogene Blue BB.	II—III.
Diamine Azo Blue RR pat. *1) developed with Beta-Naphtol* 1½%  3% 	For direct dyeing see page 40.	Same as with Diaminogene Blue BB.	II—III.
2) developed with Naphtylamine Ether N 1½%  3% 		Same as with Diaminogene Blue BB.	II—III.

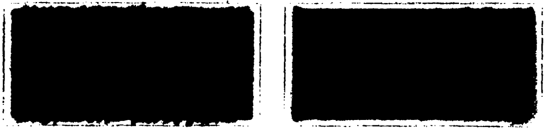
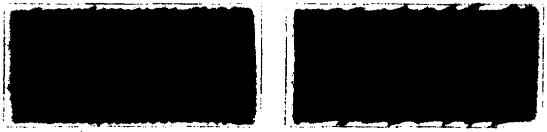
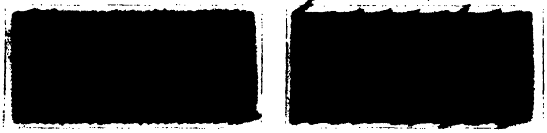
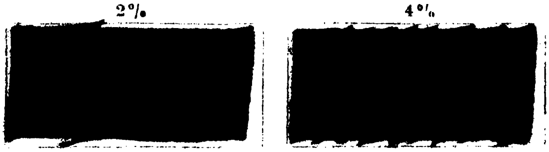
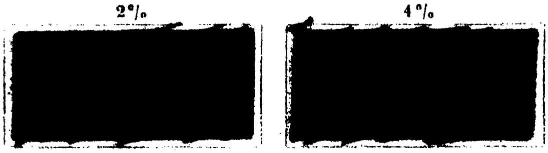
Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
Good.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.	The shade becomes rather duller. The fastness to light is increased to III—IV.	*Behaves similarly to Diaminogene Blue BB. The shade is less bright but considerably deeper. Very well suited for the production of dark Indigo shades.*
Good.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.	The shade becomes but slightly duller. The fastness to light is increased to III—IV.	*The dyestuff resembles Diaminogene Dark Blue in its properties, the shade, however, being considerably brighter.*
Very good.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.	The shade becomes but slightly duller. The fastness to light is increased to III.	*Diamine Azo Blue R and RR developed with Beta-Naphtol are extensively employed, both as self colours and in mixtures with Diaminogene Blue BB for the production of Indigo blue shades.* *Both products yield very bright navy blues when developed with Naphtylamine Ether N.* *Besides being of a different shade, Diamine Azo Blue R may in distinction to Diamine Azo Blue RR be easily discharged white.*
The shade becomes brighter.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.	Same as with the colours developed with Beta-Naphtol.	
Very good.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.	The shades of these two developed colours become much redder and duller by the aftertreatment with sulphate of copper; Diamine Azo Blue RR is therefore very much inferior to the above brand of Diamine Azo Blue R in respect to this aftertreatment.	
Very good.	II—III.	Not fast to chloring.	Same as with Diaminogene Blue BB.		

Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diamine Heliotrope G pat. **developed with Beta-Naphtol* 1½% 3% 	For direct dyeing see page 36.	Same as with Diamine Azo Blue R.	II—III.
Diamine Heliotrope B and **O** pat. *developed with Beta-Naphtol* B 3%  O 3% 	For direct dyeing see page 38.	Behave exactly like	
Diamine Blue Black E pat. *1) developed with Beta-Naphtol* 1½%  3% 	For direct dyeing see page 52.	In fastness to washing and milling as good as Diamine Black BH, but inferior in respect to not staining white cotton.	II.
2) developed with Naphtylamine Ether N 1½%  3% 		Same as when developed with Beta-Naphtol.	II.
3) developed with Fast Blue Developer AD pat. 1½%  3% 		Nearly, but not quite as good as when developed with Beta-Naphtol.	II—III.

Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
Very good.	II.	Not fast to chloring.	The shade is not altered, the wool being tinted reddish but very slightly.	The fastness to light is increased by an aftertreatment with sulphate of copper.	*The developed blue shades are not so bright as those of Diamine Azo Blue R, but have the advantage of greater fastness to cross-dyeing and are therefore of special importance for blue warps for plushes.*
Diamine Heliotrope G.			Not quite so fast as dyeings of Diamine Heliotrope G.	By an aftertreatment with sulphate of copper the fastness to light of Diamine Heliotrope B is increased to III—IV and that of Diamine Heliotrope O to III.	
Very good.	III.	Not fast to chloring.	Wool is rather strongly stained in medium and dark shades.	The shade becomes more reddish, whilst the fastness to light is increased considerably, to III—IV.	*Diamine Blue Black E serves for the production of developed blue shades which are brighter, although less fast to washing, than those of Diamine Black BH.* *The brightest blue is obtained when developed with Naphtylamine Ether N, whilst that produced with Fast Blue Developer AD is faster to light. The blues developed with Beta-Naphtol or with Naphtylamine Ether N can however also be rendered more resistant to light by an aftertreatment with sulphate of copper.*
The shade becomes brighter.	II—III.	Not fast to chloring.	Same as when developed with Beta-Naphtol.	Same as when developed with Beta-Naphtol.	
Same as when developed with Naphtylamine Ether N.	III.	Not fast to chloring.	Same as when developed with Beta-Naphtol.	The fastness to light is increased materially; the shade, however, is turned more to a reddish blue.	

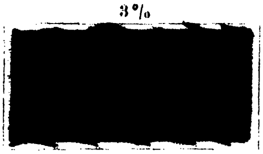
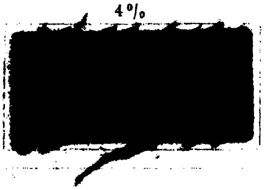
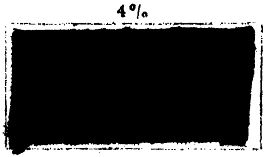
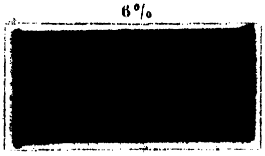
Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diamine Black BH pat. *1) developed with Beta-Naphtol* 1½ % 3 % 	For direct dyeing see page 52.	In pale and dark shades very fast to washing and milling. White cotton is stained only very triflingly.	II.
2) developed with Naphtylamine Ether N 1½ % 3 % 		In point of fastness to washing and milling almost equal to the shade obtained with Beta-Naphtol.	II.
3) developed with Fast Blue Developer AD pat. 1½ % 3 % 		Similar to the shade obtained with Development 2.	III.
4) developed with Phenylene Diamine 2 % 4 % 		Same as with Development 1.	II.
5) developed with Resorcine 2 % 4 % 		Similar to the shade obtained with Development 1.	II.

Besides the above-mentioned developers, Blue Developer AN* comes into consideration for Diamine Black BH, yielding
to light than Diamine Black BH

Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
Very good.	III—IV.	Not fast to chloring.	Pale shades do not stain the wool at all and dark shades but very little.	The shade becomes a little duller. The fastness to light is increased to III—IV.	*The deep blue black obtained by developing with Beta-Naphtol is chiefly used in mixtures with Diamine Azo Blue and Diaminogene Blue for cheap dark blues and less frequently for self shades of developed Diamine Black BH.*
Turns a trifle bluer.	III.	Not fast to chloring.	Very good, same as shade obtained with Beta-Naphtol.	Same as shade obtained with Beta-Naphtol.	*The navy blue shade obtained with Naphtylamine Ether N is distinguished both by good fastness to washing and low cost of production. It finds extensive application as a self colour or in combination with Diamine Azo Blue R for loose cotton, yarns, piece goods and hosiery.*
Very good.	III.	Not fast to chloring.	Slightly inferior to shade obtained with Beta-Naphtol.	The shade is changed very much to a reddish blue.	*The blue is less bright, but considerably faster to light than that obtained with Naphtylamine Ether as a Developer.*
Turns a trifle bluer.	III—IV.	Not fast to chloring.	As good as shade obtained with Development 1.	The shade becomes a little duller. The fastness to light is increased to III—IV.	***Is very extensively used as a cheap black fast to washing and acids for loose cotton, yarns, piece goods and hosiery. Diamine Black BH belongs to the best levelling colours and is therefore very much employed for dyeing cops, cheeses and sliver.***
The shade is rather bluer after subsequent rinsing.	III.	Not fast to chloring.	Same as shade obtained with Development 4.	The shade is altered too much towards a reddish blue.	***Resorcine is but seldom used alone, but very frequently in combination with Phenylene Diamine for developing a deeper and finer black than can be obtained with Phenylene Diamine alone.***

dyeings of a somewhat duller shade, which are slightly inferior in point of fastness to washing but of a little better fastness developed with Naphtylamine Ether N.

Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diamine Black RO pat. and **BO** pat.	Both products are developed like developed shades of these two dyestuffs is Black BH.		
Diamine Azo Black B pat. *1) developed with Beta-Naphtol* 2 % 3 %  *2) developed with Phenylene Diamine* 2 % 3 % 	Dyed with 1 % soda ash and 20 % Glauber's salt.	Very good, same as with Diamine Black BH.	II.
Diamine Beta Black B pat. *developed with Beta-Naphtol* 4 %  6 % **Diamine Beta Black BB** pat. *developed with Beta-Naphtol* 4 %  6 % 	Dyed with 2 % soda ash and 20 % Glauber's salt.	Possess the same fastness to washing as developed Diamine Black BH.	II.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
Diamine Black BH and yield similar results, with a slightly duller shade. The fastness to hot pressing of all a little inferior, the fastness to milling and acids however a little superior to that of developed Diamine					
The shade becomes a trifle lighter.	III—IV.	Not fast to chloring.	Resist cross-dyeing with acids very well. When developed with Beta Naphtol, the wool is stained very little; developed with Phenylene Diamine the wool is not tinted at all.	Both methods of developing yield somewhat more reddish shades; the fastness to light increases to III–IV.	*Diamine Azo Black B is distinguished by excellent covering power, a deep and full black being already obtained by diazotising and developing a dyeing produced with 3 °/₀ Diamine Azo Black B.*
The shade is a trifle bluer after rinsing.	IV.	Not fast to chloring.	Not quite so good as developed Diamine Black BH.	The shade becomes duller and redder; this aftertreatment is therefore of less importance for these two colours.	*Diamine Beta Black developed with Beta Naphtol alone already yields very fine deep blacks. With Naphtylamine Ether N navies are obtained and with Resorcine dark green shades, which are however of not nearly the same importance as the blacks developed with Beta Naphtol.*

Dyestuff and Developer	Direct Dyeing	Fastness to Washing	Fastness to Light
Diaminogene B pat. *1) developed with Beta Naphtol* 1½% ■ 3% ■	For direct dyeing see page 60.	Nearly as fast to washing as Diamine Black BH developed with Beta Naphtol. Dark shades washed together with white cotton tinge it only triflingly.	III.
2) developed with Phenylene Diamine 3½% ■ 5% ■			
3) developed with Resorcine 3½% ■ 5% ■			
Diaminogene extra pat. *1) developed with Beta Naphtol* 1½% ■ 3% ■	For direct dyeing see page 60.	Approaching Diaminogene B.	III—IV.
2) developed with Phenylene Diamine 4% ■ 5% ■			
3) developed with Resorcine 4% ■ 5% ■			
Diaminogene BW and **CCL**	The products are closely related		

Developed Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Aftertreatment with Sulphate of Copper	Remarks
The shade is a little more greenish after rinsing.	IV.	Not fast to chloring.	Similar to Diamine Black BH.	The shade is not much altered, but the fastness to light of all three developed colours increases to at least III—IV.	*Of these two excellent developing colours, Diaminogene B finds the most extensive application owing to its yielding a deeper shade of black than Diaminogene extra; the latter is on the other hand preferred for the production of specially fine blacks with a blue cast. Both colours are frequently used in combination with each other.* *Diaminogene Black is today one of the best known colours in the manufacture of weaving yarns, sewing threads, knitted, hosiery and piece goods, owing to its excellent fastness to light and the special fulness of its shade.* *Besides for ordinary cotton goods, it is extensively employed on mercerised yarns and pieces.* *The developers most frequently used are: Phenylene Diamine by itself, Phenylene Diamine in combination with Beta Naphtol, and a mixture of Phenylene Diamine and Resorcine, the latter yielding the shade nearest to that of Aniline Black.*
The shade is a little more bluish after rinsing.	IV.				
The shade becomes rather bluer.	III—IV.				
The shade becomes a trace lighter.	IV.	Not fast to chloring.	In cross-dyeing with acids, the wool takes up a little more dyestuff than in the case of Diaminogene B.	Behaves similarly to Diaminogene B and the fastness to light increases to IV.	
Very good.					
The shade becomes rather bluer.					

to Diaminogene B; they possess almost the same properties of fastness, but are deeper in shade.

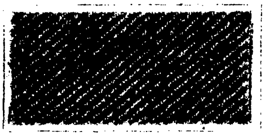
Appendix to page 92.

Referring to the remarks on page 92 it may be pointed out that shades dyed with Primuline turn more orange on being treated with a chloride of lime solution, gaining at the same time considerably in fastness to washing and milling.

This aftertreatment may be carried out by working the direct Primuline dyeings for about $^1/_2$ hour in a cold bath of chloride of lime 1^0 Tw., rinsing, souring off with hydrochloric acid and again rinsing thoroughly.

The yellowish orange shade thus resulting may be seen from the following patterns.

4%



6%

The fastness to washing and light is very good, likewise the fastness to stoving and hot pressing. Interwoven with woollen yarn, the dyeings resist the cross-dyeing of Union goods in an acid bath and are in this respect equal to Diamine Yellow N aftertreated with chromium fluoride (see page 80).

IV.

The Production of Coupled Dyeings

with a tabular survey of their properties and fastness.

Regarding the classification into degrees of fastness, "IV" denotes the highest and "I" the lowest standard. Thus, "IV" indicates a fastness to light corresponding with that of Indigo, whilst the fastness of Congo Red is expressed by "I".

The Production of Coupled Dyeings.

A certain number of Diamine Colours can be fixed with Nitrazol C or Paranitraniline, by the so-called Coupling Process, in a similar way as by diazotising and developing.

An advantage of this process is that it is carried out in one bath only.

The shades produced by coupling are as fast to washing and milling as those obtained by developing, and they possess, besides, a prominent fastness to acids.

The dyestuffs suitable for coupling are:

Diamine Nitrazol Black B	for Black
Oxy Diamine Black A	
Oxy Diamine Black D	
Oxy Diamine Black AM	
Oxy Diamine Black JB	
Oxy Diamine Black JEI	
Oxy Diamine Black JW	
Oxy Diamine Black UI	
Diamine Blue NC	for Blue
Diamine Nitrazol Brown RD	for Brown
Diamine Nitrazol Brown BD	
Diamine Nitrazol Brown G	
Diamine Nitrazol Brown B	
Diamine Nitrazol Brown T	
Oxy Diamine Orange G and R	
Oxy Diamine Brown G	
Cotton Brown A	
Cotton Brown N	
Diamine Brown S	

Primuline Diamine Fast Yellow A Diamine Bronze G Diamine Grey G	for yellow and mode shades.

In addition to these, the following come into consideration for dark browns:

Diamine Jet Black OO
Diamine Jet Black SS
Diamine Jet Black Cr
Diamine Jet Black RB
Oxy Diamine Black SA
Oxy Diamine Black RR

which, coupled with Nitrazol or Paranitraniline, yield shades very fast to milling and of good resistance to acids. They were formerly frequently employed for dark browns before the various Diamine Nitrazol Browns were introduced.

The coupling is effected by treating the dyed and rinsed cotton goods for ½ hour in one of the cold coupling baths charged as below.

Coupling with Nitrazol C pat.

For 100 lbs. cotton

for 1½–2% dyeings with:	for 3–4% dyeings with:
2 lbs. Nitrazol C pat.	3—4 lbs. Nitrazol C pat.
½ lb. soda ash	¾—1 lb. soda ash
3¼ oz. acetate of soda.	3—4 oz. acetate of soda.

To dissolve the Nitrazol C, it should be stirred up with a little cold water (68—77 ° F). Any lumps that may have formed should be carefully broken up, and the Nitrazol should finally be brought into solution by pouring a sufficient quantity of cold water over it.

The coupling bath is charged by first adding the solution of Nitrazol, then the soda, and finally the acetate of soda.

The cotton is worked in this cold bath for ½ hour and rinsed as usual.

2) Coupling with Paranitraniline C.

For 100 lbs. cotton.

for 1½%—2% dyeings with:	for 3—4% dyeings with:
4½ gallons diazotised Paranitraniline C	about 6¼—8¾ gallons diazotised Paranitraniline C
½ lb. soda ash	¾—1 lb. soda ash
3½ oz. acetate of soda.	4¼—6¼ oz. acetate of soda.

The diazotised Paranitraniline is prepared as follows:

Dissolve

2 lbs. Paranitraniline C with

2 gallons boiling condensed water, stir well, and then add

5 pints hydrochloric acid 33° Tw.; after some stirring, complete solution will have set in; then add

4¼ gallons cold water, which precipitates the hydrochloride of Paranitraniline in the form of a yellow paste.

This solution should always be prepared a few hours before it is used in order to give it time to cool down by standing. When quite cold, add

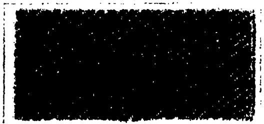
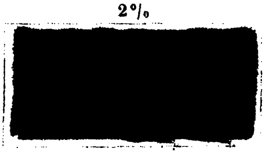
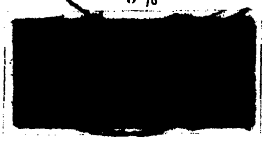
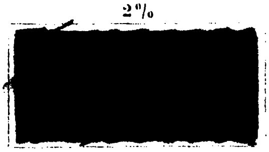
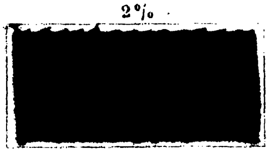
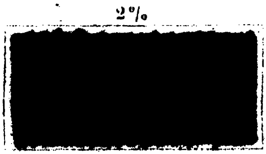
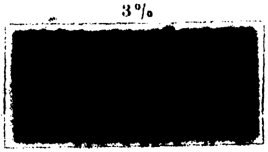
1½ lb. nitrite of soda dissolved in

7 pints cold water, whilst stirring. After about 20 minutes, a clear solution results, which is then brought up to 25 gallons with cold water.

The diazo solution will keep for some time if preserved in wooden or earthen vessels and protected from heat or sunlight.

Basic dyestuffs may be added to the coupling bath for shading purposes; thus for instance: 0.2—0.3% New Methylene Blue for coupled Blacks.

When coupling dyeings of loose cotton it has proved advantageous to omit the additions of soda ash and acetate of soda and to work with the respective Nitrazol or Paranitraniline solutions only; their quantity should however in such a case be increased by one quarter.

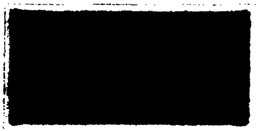
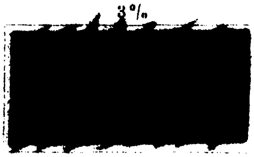
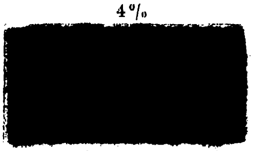
Name of the Colour	Direct Dyeing	Fastness to Washing	Fastness to Light
Primuline 4 %  6 %	Dyed with the addition of 20—30 % Glauber's salt or common salt.	The fastness to washing and milling is very good. White cotton washed with it is slightly stained.	I—II.
Oxy Diamine Orange G 2 %  3 % 	For direct dyeing see page 18.	The fastness to washing and milling is very good. White cotton washed with dark shades is but slightly stained.	II.
Oxy Diamine Orange R 2 %  3 %		The fastness to washing and milling is very good. With regard to not bleeding into white cotton superior to the "G" brand.	
Oxy Diamine Brown G 2 %  3 %	For direct dyeing see page 20.	Same as with Oxy Diamine Orange R.	II—III.
Cotton Brown N 2 % 3 %	For direct dyeing see page 18.	The fastness to washing is as good as that of Oxy Diamine Brown G, but a little inferior as regards not bleeding.	II.
Cotton Brown A 2 %  3 % 			

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Remarks
The shade is a little brighter after rinsing.	II–III.	Not fast to chloring.	Not suitable for cross-dyeing in an acid bath.	*Primuline coupled with Nitrazol is chiefly used for shading brown colours to the yellow side and as a yellow element in mode shades.*
Not fast to stoving.	II–III.	Not fast to chloring.	The dyeings stand cross-dyeing of the wool in an acid bath very well, the wool not being stained at all or hardly perceptibly so.	*The two Oxy Diamine Oranges yield, when coupled, deep red brown shades of excellent fastness to washing and milling which are used for yarns and hosiery goods and also for loose cotton.*
	II.			
Not fast to stoving.	III.	Not fast to chloring.	Same as with Oxy Diamine Orange R.	*The coupled dyeings are similar in shade to those of Oxy Diamine Orange G, but deeper and browner.*
The shade becomes a trifle more reddish.	IV.	The dyeings cannot be termed fast to chloring, though they resist a short passage in a weak solution of chloride of lime.	The fastness to acids is good. Wool dyed with it is slightly stained.	*The fastness to milling of the coupled Cotton Browns is not so good as that of the other coupling browns; they are however employed for knitting yarns and hosiery goods owing to their excellent shade, which resembles that of Cutch.*
The shade becomes a trifle more orange.				

Name of the Colour	Direct Dyeing	Fastness to washing	Fastness to Light
Diamine Nitrazol Brown G pat. 2% ■ 3% ■	Dyed with 2% soda ash and 20% Glauber's salt.	Fastness to washing and milling same as with Cotton Brown; somewhat better than the latter however as regards not bleeding.	II.
Diamine Nitrazol Brown B pat. 2% ■ 3% ■	Same as with Diamine Nitrazol Brown G.	The fastness to washing and milling is excellent. White cotton washed with it is stained hardly perceptibly.	II – III.
Diamine Nitrazol Brown BD pat. 2% ■ 3% ■	For direct dyeing see page 26.	Similar to Diamine Nitrazol Brown B. Still better as regards not bleeding.	II – III.
Diamine Nitrazol Brown RD pat. 2% ■ 3% ■	For direct dyeing see page 26.	Similar to Cotton Brown N.	II – III.
Diamine Nitrazol Brown T pat. 2% ■ 3% ■	Dyed with 2% soda ash and 20% Glauber's salt.	Same as with Diamine Nitrazol Brown BD; very good.	III.
Diamine Brown S pat. 2% ■ 3% ■	For direct dyeing see page 22.	Similar to Diamine Nitrazol Brown BD.	II—III.

Dyeings.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Remarks
Not fast to stoving.	III-IV.	Not fast to chloring.	Fast to acids. Wool is hardly at all stained in cross-dyeing; Diamine Nitrazol Brown T is the best in this respect.	*The various Diamine Nitrazol Browns and Diamine Brown S serve for the production of cheap shades fast to washing and milling.* *The dyeings are distinguished by excellent fastness to milling and acids, and are extensively used for yarns and loose cotton.* *Diamine Nitrazol Brown T, either alone or in mixture with the other Diamine Nitrazol Browns, is chiefly used for dyeing warps in shades fast to acids, because it bleeds the least into the wool in cross-dyeing.*
	III—IV.			
	III-IV.			
	III—IV.			
	III.			
	II—III.			

Name of the Colour	Direct Dyeing	Fastness to Washing	Fastness to Light
Diamine Bronze G pat. 2 % 3 % 	For direct dyeing see page 24.	Fastness to washing and milling very good. White cotton washed with deep shades is slightly stained.	III.
Diamine Grey G pat. 2 % 3 % 	For direct dyeing see page 26.	Fastness to washing and milling very good.	III.
Diamine Blue NC pat. 2 % 3 % 	For direct dyeing see page 48.	The fastness to washing is not quite so good as that of Diamine Nitrazol Black.	II--III.
Diamine Nitrazol Black B pat. 3 %  4 % 	Normal, as indicated on page 7.	The fastness to washing and milling is excellent. Washed with white cotton the white is only triflingly tinged, similarly as with the developed shades.	II.
Oxy Diamine Black A pat. 3 % 4 % 	For direct dyeing see page 58.	Same as with Diamine Nitrazol Black.	II.
Oxy Diamine Black JEI pat. 3 % 4 % 	For direct dyeing see page 60.	The fastness to washing and milling is a little better than that of Diamine Nitrazol Black.	II.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Remarks
The shade is a little brighter after rinsing.	III.	Not fast to chloring.	Not suitable for cross-dyeing in an acid bath.	*Both products serve only for shading and for the production of mode shades fast to washing and milling.*
Very good.	IV.		The shades resist cross-dyeing in an acid bath, the wool being hardly stained at all.	
The shade is a little brighter after rinsing.	III.		Does not come into consideration for goods to be cross-dyed in an acid bath, as the wool would become tinted.	*As a coupling product Diamine Blue NC serves in the first place for producing dark blue and blue black shades, and also as the blue element for shading dyeings to be coupled.*
The shade becomes somewhat redder.	III—IV.		The dyeings withstand cross-dyeing of the wool in an acid bath very well. By prolonged boiling the wool is however slightly stained.	*Diamine Nitrazol Black yields a very good black fast to washing and milling, which is used for yarns, loose cotton and piece-goods.* *For brightening the shade, a little New Methylene Blue may be added to the Nitrazol bath.*
Very good.	II—III.		Same as with Diamine Nitrazol Black.	*Both products when coupled yield good blacks fast to milling, which are employed for the same purposes as Diamine Nitrazol Black and the cost price of which is very low, a direct shade dyed with 3—3½ % dyestuff being sufficient for a coupled black.*
The shade is a little redder after rinsing.	III—IV.		The colours stand cross-dyeing of wool in an acid bath very well, the staining of the wool being hardly perceptible.	*Oxy Diamine Black A dyes a bluish and JEI a greenish deep black, which may be brightened by adding a little New Methylene Blue to the coupling bath.* ***Oxy Diamine Black D, AM, JB, JW and UI can also be coupled with Nitrazol and yield results similar to those obtained with Oxy Diamine Black A and JEI.***

B. Immedial Colours.

The Storing and Dissolving of the Immedial Colours.

Storing. The Immedial Colours should always be stored in a dry room and protected from moisture. Care should also be taken to cover the kegs up well, after each draw of colour.

Dissolving. The Immedial Colours are best dissolved in wooden vessels by pouring over them hot water containing a part of the sodium sulphide required for the dyeing process. Vessels, pipes or fittings of copper or brass should be avoided both for dissolving and for dyeing. The metallic parts necessary should be of either iron or lead.

Immedial Sky Blue paste is dissolved in the following manner:

The sodium sulphide required for the dyeing process is dissolved in about ten times its weight of boiling water, to which is added half the prescribed quantity of soda ash. This liquor is well mixed in a wooden vessel with the Immedial Sky Blue paste and hot water added till completely dissolved. The dissolving is accelerated by a short boiling; prolonged boiling is unnecessary, the colour dissolving very rapidly.

The Dyeing of Immedial Colours.

Dyeing. Vessels constructed either of iron or wood are best suited.

Copper has an injurious effect on the liquor only; dyed cotton may after rinsing come into contact with any kind of metal without suffering in any way.

The dye-bath is charged with soda, sodium sulphide and common salt or Glauber's salt. The quantities of each required for the various colours are given with the separate methods of dyeing.

Effect of Sodium Sulphide. Sodium sulphide fulfils the very important mission of keeping the colour in solution during the dyeing process, and the aspect of the dye liquor is therefore a reliable guide as to the correctness of the addition made: a sufficiently large quantity of sodium sulphide keeps the bath absolutely clear, whereas an insufficient addition renders it turbid, and the liquor, if dropped on white blotting paper, shows a visible precipitation. In the latter case a further addition of sodium sulphide brings the bath up to the required condition.

It is specially requisite to restore the bath in this way, either after prolonged disuse or after too severe boiling. Unnecessary and excessive boiling should therefore be avoided, because it favours oxydation of the sulphide too much. On the other hand, an excess of sulphide cannot be recommended, the dyeings thereby remaining thin.

Sodium sulphide is sold in normal strength as "crystallised" and in double strength as "concentrated" sulphide. Both qualities are applied alike.

Effect of Soda Ash.

Soda ash is added in order to preserve the alkalinity of the dye-bath and to increase the effect of the sodium sulphide. In some cases soda ash is substituted by caustic soda lye.

Effect of Salts.

Common salt and Glauber's salt promote the exhaustion of the dye-baths in a similar manner as when employed in dyeing with Diamine Colours.

For pale shades the quantities of common salt or Glauber's salt must be moderated, whilst dark shades require an increase of salts.

In order to control the amount of salts contained in the dye-baths which are in constant use, gravity tests should be frequently made with a hydrometer. For dyeing blacks, the cold liquor may stand at 8 or 10° Tw., but for Immedial Blues and the other colours it should not exceed 4 or 4½° Tw. Should the gravity of the liquor be higher, the addition of salt may be dispensed with when dyeing the next few batches.

Common salt or Glauber's salt may be employed with the same result, 10 parts of common salt being equal to 12 parts of calcined Glauber's salt or 24 parts of crystallised Glauber's salt.

For dyeing in machines, crystallised Glauber's salt should be given the preference.

Other Additions to the Dye-baths.

Other additions are sometimes made, but only in special cases, as, for instance, dextrine or sodium chromite for the dyeing of black on piece goods, or Turkey-red oil for the dyeing of Immedial Sky Blue on hanks or loose cotton, or for Immedial Black on warps etc. in order to facilitate penetration.

Preserving the Dye-baths.

The dye-baths may be preserved for constant use without fear of deterioration. If the sodium sulphide contained in the liquor should become oxydised by prolonged contact with the air and the colouring matter be thereby precipitated, the dye-bath merely needs boiling up and the addition of some fresh sodium sulphide to be fit for use again.

Temperature of the Dye-baths. The Immedial Colours are generally dyed by boiling up the dye-bath charged with all the ingredients, shutting off steam and entering the goods and dyeing to the finish at or near boiling temperature.

An exception is made with Immedial Sky Blue, this colouring matter being always dyed at a low temperature, about 70—85° F.

Dyeing in a cold bath. The other Immedial Colours can also be dyed equally well in a lukewarm or even in a cold bath; dyeing in a hot bath is recommended more for well known general practical reasons than for any special properties of the Immedial Colours themselves. The method of dyeing in a cold or lukewarm bath is exactly the same as in a hot bath except that the starting bath must be prepared with a considerably larger quantity of colouring matter and consequently also with more sodium sulphide.

When dyeing hot, it should also be borne in mind that continuous and violent boiling must be avoided in order to prevent the oxydation of the sodium sulphide.

Whether the goods be dyed partly above or entirely below the surface of the liquor is of minor importance.

Squeezing and Rinsing after Dyeing. It is very important that the goods be squeezed as perfectly as possible, and rinsed immediately after dyeing. The more thoroughly and evenly the goods are squeezed and rinsed, the greater will be their resistance to rubbing and the more even the shade.

The first rinsing bath, which will contain a fair amount of dyestuff, may be added to the dye-bath again or serve for dissolving the next addition of colouring matter.

In dyeing Immedial Blue C and CR there is a deviation in the process in so far as the cotton must not be rinsed after dyeing, but only well squeezed or evenly wrung and steamed in this state.

Stripping.

Should it be necessary to strip the colour partially off the goods, they are passed through a hot bath of sodium sulphide, as the ordinary soap or soda bath has very little effect upon Immedial Colours. This bath is prepared with about 3—12 oz of sodium sulphide per 10 gallons of water, and the cotton is worked in this liquor, for a few minutes only or even up to half an hour according to the requirement of the case.

The Aftertreatment of Immedial Colours.

The following processes are protected to us by Patent:

Aftertreatment with chromium salts,
Aftertreatment with acetate of soda,
Steaming with admission of oxygen,
Treatment with the peroxides of hydrogen or of sodium,
and
Development of brown dyeings with Nitrazol.

Buyers of our Immedial Colours acquire by their purchase and use of such colours the right to apply these patented methods of aftertreatment.

Aftertreatment of Dyeings with Chromium Salts.

The aftertreatment with chromium salts is resorted to chiefly in the case of Immedial Black, whilst for Immedial Brown, bichromate of potash and sulphate of copper are to be preferred. The aftertreatment of Immedial Black chiefly serves the purpose of varying the shade according to requirements, whereas in the case of Immedial Brown it improves the fastnes to light.

The following tables indicate, for which brands of Immedial Colours, or in which special case, an aftertreatment with metallic salts is of advantage.

Aftertreatment with Acetate of Soda.

This aftertreatment is of especial importance for blacks produced with Immedial Black, and should be applied in every case unless the dyeings be subjected to one of the usual alkaline finishing operations, such as soaping, oiling etc. For this purpose, 3—5 oz of acetate of soda per 10 gallons of water are added to the last rinsing bath; the cotton is worked in this liquor for a few minutes and dried without being rinsed again.

If the yarns or pieces are subjected to some finishing process, the acetate of soda may be added to the finish.

In the case of dyeings which are scrooped with acids, as is frequently done with yarns, the acetate of soda should be added direct to the scrooping bath.

The cotton hanks are then soaped as usual and passed through a bath containing, instead of acetic acid alone,

1 pint of acetic acid
$^1/_2$—1 lb. of acetate of soda per 10 gallons of liquor.

Developing Immedial Blue C and CR by Steaming.

This operation may be very easily carried out in any box made either of wood, copper or iron, or equally well in an ordinary dye-vat.

It should in any case be observed that the cotton must *not* be rinsed after dyeing, but simply well hydro-extracted or otherwise freed from an excess of liquor before being subjected to the steaming process.

Yarns and pieces are suspended on laths in the steam-box so that the steam may penetrate the goods evenly, whereas loose cotton or warps should only be piled up in layers of reasonable height. The steam-box remains closed during the steaming operation. If the steam-box be constructed of wood, the lid should be covered with felt or woollen cloth in order to render it as tight as possible.

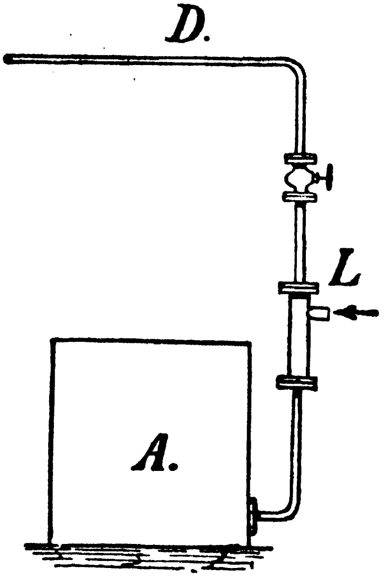
The steam is best introduced at the lower part of the box in order to allow the condensed water to run off freely, and altogether care must be taken to prevent any condensed liquid from spotting the goods.

Very wet steam may however be rendered more serviceable by placing along the bottom of the box a gilled steam pipe for heating the box previous to charging it with the goods.

The hotter and drier the steam, the more rapid is the developing and the brighter the shade of the blue.

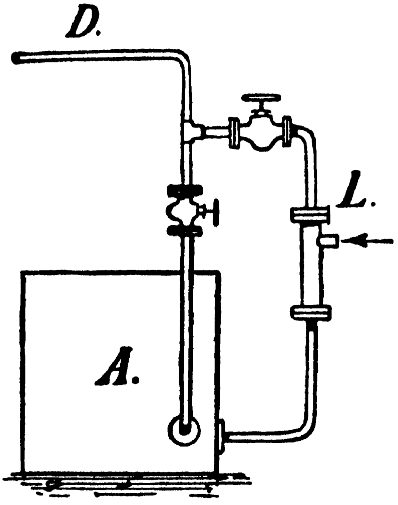
Air is also introduced into the steam-box simultaneously with the steam. This is done by means of a small injector*) which is adjusted between the steam pipes by means of two flanges as shown below in diagram I.

Sketch No. 1 illustrates the steaming arrangements of a box used for steaming only. For vessels intended to serve also for dyeing



I

A steam box of any convenient shape,
L air injector,
D steam conduit.



II

A steam box,
L air injector branched off from the steam pipe,
D steam conduit.

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*) For the convenience of our customers we hold a supply of these air and steam injectors, which we are pleased to furnish at 15 sh. a piece.

without disturbing the existing arrangement of the steam pipes, a short branch pipe may be introduced as shown in diagram II on the preceding page. This arrangement allows of the alternate admission, according to requirement, of either steam alone or steam and air.

After steaming, the goods are rinsed in hot water and then dried or previously soaped as required.

Developing by Smothering.

Similar to developing by steam is the developing of Immedial Blue by smothering the dyed, moist cotton (loose cotton, yarn or piece).

The method of working is as follows:

The dyed and hydro-extracted cotton, the heat of which must be retained as well as possible, is placed into skeps or wooden boxes, the inside of which is lined either with oiled brown paper or oil-cloth (American cloth); these receptacles are then covered up in order to prevent a cooling or drying of the contents, and placed for a few hours, or overnight, in the drying room.

The developing of the blue in this manner is best carried out with the temperature of the drying room at 140—160° F.

For smothering piece goods and warps, the same may be placed in the ordinary dyers' barrows, but care must be taken to place them in such a way that they do not dry where they touch the sides and that they retain their heat for a few hours.

After lifting, the cotton is rinsed in hot water.

Developing Immedial Blue with Sodium Peroxide or Hydrogen Peroxide.

Immedial Blue can also be developed by the application of the peroxides of sodium or hydrogen: the fact however that steaming is a cheaper and less complicated process accounts for the diminishing employment of these chemicals.

Developing with Sodium Peroxide.

A wooden vessel containing no more cold water than is necessary for working the material in, is charged

for pale shades, with	$1^{1}/_{2}$ % sodium peroxide $1^{1}/_{2}$ % sulphuric acid 168° Tw.
for medium and dark shades, with	$2-2^{1}/_{2}$ % sodium peroxide $2-2^{1}/_{2}$ % sulphuric acid 168° Tw.

The acid is first added to the bath, in which the material is given a few turns; the yarn is then raised from the bath and the sodium peroxide, which has been previously dissolved in cold water, is added. The material is again entered and turned for about $^{1}/_{4}$ hour, and the bath is subsequently heated gradually to about 140° F. in the course of 20 minutes. The usual rinsing and hot soaping completes the process.

NB. The bath should remain slightly alkaline and consequently not redden blue litmus paper.

If hydrogen peroxide be used instead of sodium peroxide, the proportions are as follows:

for pale shades:	$12-20$ % hydrogen peroxide $1^{1}/_{2}-2$ % ammonia
for medium and dark shades:	$20-25$ % hydrogen peroxide $2-2^{1}/_{2}$ % ammonia.

Larger quantities of the peroxides than those stated above increase the brightness of the dyeings, diminishing, however, their fastness to washing.

NB. The vessel used for developing with sodium peroxide must be perfectly clean and should best be boiled out with some sodium peroxide and sulphuric acid before being used.

Developing Immedial Blue by Topping in the Indigo Vat.

Immedial Blue can also be developed by topping with Indigo instead of being steamed, the reducing action of the Indigo vat also developing the blue shade of Immedial Blue. The exact method of procedure is described in chapter F, "Combinations of various colouring matters".

Aftertreatment of Immedial Brown with Nitrazol.

This aftertreatment, the so-called "coupling process", causes the shades to turn considerably yellower and very much deeper.

The coupling is carried out exactly as described on page 111.

The Shading of Immedial Colours.

Topping with basic dyestuffs.

Apart from the fact that the various Immedial Colours may be mixed at will with one another, the simplest way of shading off is to top the dyeings with basic dyestuffs.

The Immedial Colours possess the property of fixing basic dyestuffs to a still greater degree than the Diamine Colours. The fastness of the dyeings is not impaired by this process, provided it is not resorted to more than just necessary for brightening the shades, for which purpose 0,2—0,4 °/o of the basic dyestuff will be entirely sufficient.

The topping is carried out by washing the goods well after dyeing and entering them into a fresh bath containing the solution of basic dystuffs.

It is done at the ordinary temperature and with an addition of 2—4 °/o acetic acid calculated on the weight of the cotton. Colours which are very rapidly exhausted should be added in solution in two or three portions.

If sufficiently soft water be at hand, the topping may also be done in a soap liquor.

Shading off with Diamine Colours.

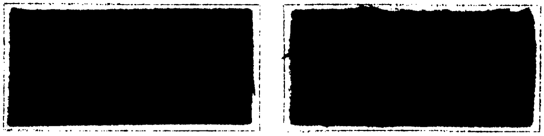
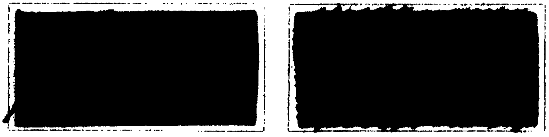
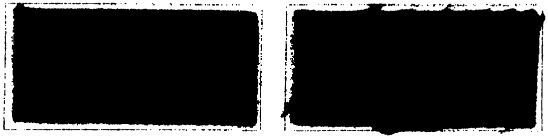
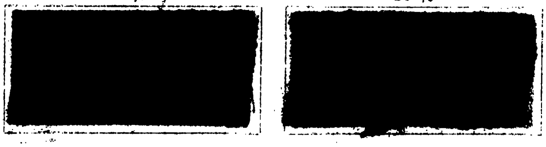
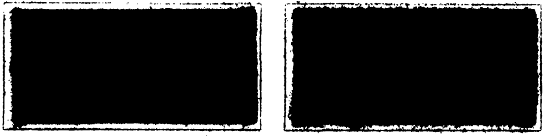
Some of the Diamine Colours, especially Diamine Fast Yellow B and Diamine Orange B, may be added straight to the dye-bath for shading purposes on account of their being well suited for dyeing in a bath containing sodium sulphide.

Various other Diamine Colours, e. g. Diamine Red 4B, Diamine Brilliant Scarlet S, Diamine Violet Red, Oxy Diamine Orange G and R may also be employed in this manner, but only in small quantities, for shading off.

A Tabular Survey

of the Properties and Fastness of the Immedial Colours.

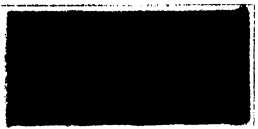
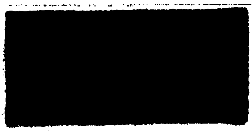
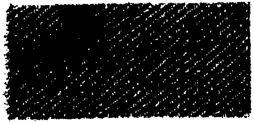
Regarding the classification into degrees of fastness, "IV" denotes the highest and "I" the lowest standard. The fastness to light of Indigo thus corresponds with "IV", whilst the fastness of Congo Red is expressed by "I". "V" indicates a fastness to light considerably superior to that of Indigo.

Name of the Colour	Quantity of Sodium Sulphide necessary for Dyeing or Dissolving respectively	Fastness to Washing	Fastness to Light
Immedial Black V extra pat. 2% 10% 	In most cases 5—7 parts of crystallised sodium sulphide for 10 parts of colouring matter will be sufficient.	The fastness to washing is exceedingly good. White cotton is not stained.	V. The fastness to light is exceedingly good and is not surpassed by any other black.
Immedial Black FF extra 2% 10% 			
Immedial Black G extra pat. 2% 10% 			
Immedial Black NB pat. 2% 10% 	7—8 parts of crystallised sodium sulphide for 10 parts of colouring matter may be taken as the normal quantity; in some cases however as much sodium sulphide as colouring matter is used.	Same as with Immedial Black V extra.	V.
Immedial Black NG pat. 2% 10% 			

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Methods of Aftertreatment	Remarks
The shades become a little more bluish, but may be termed fast to stoving.	Very good both in pale and in dark shades.	Resist a very weak chloride of lime solution; strong solutions however destroy the shade.	The shades withstand cross-dyeing of the wool in an acid bath exceedingl[illegible] well and d[illegible] not stain th[illegible] wool.	[illegible] The best methods of aftertreatment for these three brands are: 3% bichromate of potash, or 1½% bichromate [illegible] with 3% acetic acid.	*Immedial Black V and FF extra yield the finest black; the V extra brand is used for pronounced bluish blacks, whilst FF extra yields a deep black with a blue cast.* *Immedial Black FF extra, which comes nearest in shade to Aniline Black, is used most extensively for piece-goods and yarns and also for warps, whereas Immedial Black V extra serves also for shading purposes and as a bottom for Indigo.* *Immedial Black G extra yields deeper, more greenish shades than FF extra and is chiefly used in combination with the above named brands for the production of greenish blacks.*
The shades become but a trifle bluer.	Very good both in pale and in dark shades.	A little less fast to chloring than Immedial Black V extra.	Same as w[illegible] Immedial Black V extra.	[illegible] however, in order to produce bluer shades, be treated with 3% bichromate of potash and 3% acetic acid.	*These two brands do not possess the same bluish body of shade as the "extra" brands; the difference however is not great, and Immedial Black NB especially yields a black nearly as fine as obtained with Immedial Black FF extra.* *The brands NB and NG are equal in strength to the "extra" brands and somewhat lower in price.* *Immedial Black NB along with FF extra has become the most important brand and is preferred for some purposes to the "extra" brands, e. g. for dyeing piece-goods and for machine-dyeing.* *Immedial Black NG behaves similarly to NB, but dyes a deeper, more greenish black.*

Name of the Colour	Quantity of Sodium Sulphide necessary for Dyeing or Dissolving respectively.	Fastness to Washing	Fastness to Light
Immedial Black NRT pat. 2 % ■ 10 % ■	Same as with Immedial Black N B.	Same as with Immedial Black V extra; exceedingly good.	V.
Immedial Black NF pat. 2 % ■ 10 % ■			
Immedial Blue C pat. 5 % ■ 10 % ■	The same weight of crystallised sodium sulphide as of colouring matter.	Immedial Blue dyeings are superior to Indigo dyeings in fastness to washing, Indigo losing in depth of shade every time it is washed, whereas Immedial Blue even after repeated severe washing hardly loses any of its intensity.	IV.
Immedial Blue CR pat. 5 % ■ 10 % ■			
Immedial Direct Blue B pat. 4 % ■ 8 % ■	For Immedial Direct Blue B the same weight of crystallised sodium sulphide and for Immedial Direct Blue B conc. double the weight of sulphide calculated on the weight of the colouring matter.	Equal to Immedial Blue in fastness to washing, but somewhat inferior in fastness to boiling with soap and soda.	IV.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Methods of Aftertreatment	Remarks
Same as with Immedial Black N B.	Same as with Immedial Black V extra.	Same as with Immedial Black N B.	Exceeding good, lik Immedial Black V extra.	Immedial Black N R T and N F [redacted] potash turns the shade a little but not materially bluer, and in most cases an aftertreatment may be dispensed with. [redacted]	*Immedial Black N R T yields a somewhat reddish black, whereas the shade of N F comes very near to that of N B. Both products are distinguished by the property of dyeing very evenly and well through, even under most difficult circumstances; hence they are preferred for dyeing cops and cheeses in dyeing machines, but they are also most extensively used for all other kinds of goods, both alone and in mixtures with the other brands of Immedial Black.* *A more concentrated form of N R T is also known under the denomination of Immedial Black N R.*
The shade is unchanged after rinsing.	IV.	Not fast to chloring.	The shades resist the cross-dyeing of wool in an acid bath very well and do not stain the wool.	The blue is developed by steaming with admission of air (see also page 129), and after steaming the dyeings may also be topped with basic dyestuffs. Shades thus topped possess the same excellent fastness to washing and to light as when steamed (page 134).	*Immedial Blue C R differs from Immedial Blue C by its considerably brighter and a little more purple shade. Both brands are most extensively used for dyeing loose cotton, yarn and piece-goods, and also for dyeing sliver, cops or cheeses in machines.* *Their shades are equal in fastness to Indigo dyeings, but very materially lower in price.* *Immedial Blue dyeings are frequently topped with Indigo, in which case they need not as a rule be developed by steaming.*
The shade is a little plummier and brighter after rinsing.	IV.	Not fast to chloring.	Equal to Immedial Blue.	The shade becomes a good deal brighter by strong soaping and also by an aftertreatment with 1½% bichromate of potash 1½% sulphate of copper 3% acetic acid.	*Immedial Direct Blue B is less bright in shade than Immedial Blue, but offers the advantage that its dyeings need not be developed by steaming. The shade becomes much brighter by topping with basic dyestuffs which are fixed exceedingly fast to washing and to light by Immedial Direct Blue B.* *For machine-dyeing we offer another more soluble brand, viz. Immedial Direct Blue B extra concentrated, only half of which is sufficient for the same purposes.*

Name of the Colour	Quantity of Sodium Sulphide necessary for Dyeing or Dissolving respectively	Fastness to Washing	Fastness to Light
Immedial Sky Blue Paste pat. aftertreated with *bichromate of potash and sulphate of copper* 2 °/₀ 5 °/₀	10 parts of crystallised sodium sulphide to 10 parts of colouring matter are used for pale shades, and 5 parts of sodium sulphide to 10 parts of colouring matter for dark shades.	The fastness to washing is not quite so good as that of Immedial Blue, but white cotton is only faintly tinted.	III.
Immedial Sky Blue Powder pat. aftertreated with *bichromate of potash and sulphate of copper* 2 °/₀  5 °/₀			
Immedial Brown B pat. 4 °/₀ 8 °/₀ 	Half as much crystallised sodium sulphide as of colouring matter.	The fastness to washing of Immedial Brown B and of Immedial Dark Brown A is quite as excellent as that of Immedial Black, whilst Immedial Brown G dyeings lose very slightly in intensity. The fastness to washing of Immedial Brown G however is also improved by an aftertreatment with sulphate of copper and bichromate of potash.	III. Dyeings aftertreated with sulphate of copper and bichromate of potash: IV.
Immedial Brown G pat. 4 °/₀ 8 °/₀			II – III.
Immedial Dark Brown A pat. 4 °/₀ 8 °/₀			III.
Immedial Bronze A pat. 2 °/₀  4 °/₀	Same as with Immedial Brown.	Same as with Immedial Brown B.	III. If aftertreated with sulphate of copper and bichromate of potash: IV.

Fastness to Stoving	Fastness to Hot Pressing	Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Methods of Aftertreatment	Remarks
The original shade reappears after rinsing.	IV.	The resistance against chloring is comparatively speaking very good and not inferior to that of Immedial Sky Blue dyeings; on being subjected to an alkaline boiling they however suffer more than Indigo dyeings under the same conditions.	The dyeings stand acid cross-dyeing fairly well, and the wool is but slightly stained.	Besides a mixture of sulphate of copper and bichromate of potash, sulphate of copper may also be used alone.	*Of all sulphur colours, Immedial Sky Blue dyes the brightest and most brilliant blue and serves chiefly for light blues on yarns and piece-goods.* *The two brands differ only in shade, the powder dyeing a little brighter and more purple than the paste.* *Immedial Sky Blue powder is also sold in double concentration as "Immedial Sky Blue extra conc." This brand is dyed with the same additions as the other brands, but only half as much colour is necessary.*
After rinsing, the shade is somewhat lighter and more reddish.	IV.	The dyeings are not fast to chloring; only Immedial Brown G resists a weak solution of chloride of lime fairly well.	Very good; similar to Immedial Black.	May be dyed in most cases without any aftertreatment. The fastness to light is increased in all cases by an aftertreatment with: 1% bichromate of potash 1% sulphate of copper, and, by coupling with Nitrazol, bright yellowish browns of excellent fastness to washing are obtained.	*The three brands of Immedial Brown behave nearly alike. They may be mixed with one another at will and then yield for themselves or shaded with Immedial Black or Immedial Direct Blue a fine range of the various Cutch shades. They are also excellently suitable for the production of numerous modes by reason of their yielding very level shades without even requiring much sodium sulphide. The three brands are also extensively used for dyeing sliver, cops and cheeses in machines.*
Same as with Immedial Brown.	IV.	Not fast to chloring.	Same as with Immedial Brown B.	Same as with Immedial Brown B.	*Immedial Bronze possesses properties similar to those of Immedial Brown. It is frequently used for the production of mode shades.*

C. Basic Dyestuffs.

The Dissolving of Basic Dyestuffs.

Basic dyestuffs are dissolved by pouring boiling water over them; if possible, water free from lime (condensed water) should be used. Calcareous water must be corrected by adding some acetic acid.

Dyestuffs which do not readily dissolve are best mixed with some acetic acid into a paste which is dissolved by adding hot water after a few hours' standing.

Dyeing Basic Dyestuffs on Tannin Mordants.

a) Dyeing on a Mordant of Tannin and Antimony:

The method most frequently employed is to mordant the cotton first with tannic acid, or other tannins, and to fix the tannin subsequently with tartar emetic. The cotton is then well rinsed and dyed with basic dyestuffs.

Mordanting with Tannic Acid or other Tannins.

Tannic acid is principally used for mordanting, although in some cases sumac leaves may serve equally as well. Sumac extract has found less favour, as it does not offer any advantage over sumac leaves.

For a comparison of values it may be mentioned that pure tannic acid has about 4 or 5 times the strength of sumac leaves, therefore about 16—18 % sumac leaves must be used in mordanting, to replace 4 % tannic acid.

Tannic acid should always be given the preference for bright pale shades, whilst sumac leaves are preferable for dark shades which are not affected by the yellow cast imparted to the cotton when mordanted with sumac.

Tannic acid is best dissolved in warm condensed water.

For mordanting with sumac leaves, the requisite quantity is filled into a bag and suspended for about $^1/_2$ hour in the boiling mordanting bath.

Sumac extract may be added direct to the mordanting bath and used exactly like sumac leaves, $2^1/_2$—3 parts of sumac extract being equal to 1 part of tannic acid.

It is advisable when buying sumac extract to have the percentage of tannin determined, as the commercial qualities differ widely in this direction.

For simplicity's sake we shall confine ourselves to tannic acid in the following description of the mordanting process, which may serve as an example and which refers equally to the mordanting with other tannins.

The water used for mordanting with tannic acid should be free from iron if possible, as cotton mordanted in water containing iron acquires a more or less grey appearance, which is particularly objectionable for pale shades. If water free from iron is not at hand, a few drops of hydrochloric acid should be added to the mordanting liquor, whilst calcareous water is best corrected with acetic acid.

The mordanting bath is prepared:

for light shades with $1^1/_2$—2 %
for dark shades with 4 —5 % of tannic acid.

The mordanting bath is not kept in the case of light shades; for dark shades however the baths may be used continuously, in which case they are freshened up with 3—4 % tannic acid.

The above quantities refer to a mordanting bath containing a volume of liquor not more than 15—16 times the weight of the cotton. When mordanting in more liquor, the quantity of tannin should be correspondingly increased.

The cotton, which has previously been well boiled off and rinsed, is brought into the hot tannin liquor, turned several times, and then left standing immersed in and fully covered by the liquor. For pale shades, 1—2 hours' mordanting is sufficient; for dark shades the cotton generally remains in the liquor overnight.

Since the tannin is taken up best in a cooling bath, the mordanting bath for dark shades should be warm on entering, but only lukewarm or cold when the cotton is taken out.

After mordanting with tannin, the cotton is well wrung or hydro-extracted and then brought into an antimony bath *without* being rinsed.

After mordanting with tannin and tartar emetic, the cotton must always be well rinsed before it can be dyed.

Fixing with Tartar Emetic and other Salts of Antimony.

In order to fix the tannin, the mordanted cotton is worked for 20—30 minutes in a cold bath containing about $^1/_3$ or $^1/_2$ of tartar emetic of the weight of the tannin employed. After the fixation of the mordant, the cotton must be very thoroughly rinsed.

The baths of tartar emetic like those of tannic acid are used continuously and freshened up accordingly. A little soda should be added to neutralise the liberated acid which accumulates; this may be done by adding a diluted soda solution until the liquor just begins to show a slightly turbid appearance.

In place of tartar emetic some of its substitutes may be used with the same success.

The most important substitutes are: Antimony salt (a double salt of antimony fluoride and ammonium sulphate), of which about 9 parts are used in place of 10 parts of tartar emetic, and Antimonine (antimonyl calcium bilactate), of which the same weights as of tartar emetic are used. (Regarding other substitutes for tartar emetic see appendix).

When mordanting with Antimonine, about 1—2 gallons of acetic acid should also be added to every 1000 gallons of the mordanting bath.

The cotton, after mordanting or fixing with tartar emetic, must not be left exposed to the air for too long a time, otherwise the exposed parts will turn slightly brownish and appear duller after dyeing. If the material cannot be dyed the same day it has been mordanted, it should be covered with a moist cloth.

Dyeing.

The cold dye-bath is charged first with 1—1 ½ % acetic acid and subsequently with a small portion of the colour solution; the cotton is then worked in the bath for about 10 minutes. After lifting, a further portion of the colour solution is added and the cotton then turned, while the bath is slowly heated to 105° F. Finally the rest of the colour solution is added and the dyeing completed at about 140° F.

In the case of *Naphtindone* the dye-bath is charged with 3% sulphate of alumina instead of acetic acid, and the cotton turned a few times without any charge of colour, the first portion of which is only added after lifting. When the whole quantity of colour has been added and the bath has become exhausted, it is brought to the boil and the cotton turned for another 20—30 minutes.

b) Dyeing on a Mordant of Tannin and Iron.

The cotton is mordanted with tannic acid or sumac or other tannins exactly as described under a), and the fixing is done with iron salts instead of antimony salts.

This method is employed much more rarely than the one with antimony and as a rule finds application for dark shades only.

For this fixation a bath is made use of containing either pyrolignite of iron of 3—4° Tw. or 3—4 % of sulphate of iron of the weight of the cotton.

The cotton mordanted with tannin is wrung off evenly and turned for 10 or 15 minutes in the cold iron liquor without heating. It is then rinsed thoroughly and dyed as described on page 148.

Since dyeings fixed with iron are in point of fastness inferior to dyeings fixed with antimony, the process is sometimes modified by fixing the tannin first with antimony salt and darkening with iron salts afterwards, or, by saddening with iron salts only after dyeing.

In order to increase the fastness of basic dyeings, they are frequently given another passage in the tannic acid and tartar emetic baths. The goods are first turned a few times in the old tannin liquor, and after a good wringing off this operation is repeated in the old tartar emetic bath.

The dyed goods are then rinsed and dried.

Direct Dyeing with Basic Dyestuffs.

Instead of being dyed on a mordant of tannin and antimony, some of the basic dyestuffs may, similarly to the Diamine Colours, be dyed also in a salt bath, and in isolated cases are employed in this way, although the fastness to light and washing is considerably inferior.

Naphtindone BB and Irisamine G are principally used in this manner.

According to the depth of shade to be dyed, the bath is prepared with 3—5 lbs. of salt per 10 gallons of liquor; the cotton is then entered at 105—120° F. and the bath brought slowly to the boil. Irisamine may be dyed at 105—120° F. without any further heating.

Whilst the goods dyed with Naphtindone may be rinsed after dyeing, this is not advisable with Irisamine dyeings. They are simply wrung off as evenly as possible and dried at a moderate temperature.

When dyeing in the standing bath, only one half of the quantity of salt used for the first bath is added, and when working with the same bath for a long time, one-third only is necessary.

Irisamine on Yarns mordanted with Turkey-red oil.

This method serves for the production of *exceedingly bright pinks* on cotton yarns. The cotton is mordanted twice or three times with Turkey-red oil and then dyed in a cold bath.

The yarn is mordanted in lots of 1 lb. each in a liquor containing 1 part of Turkey-red oil and 2 parts of water, and after each 1 lb lot of yarn, $^3/_4$—1 pint of such a mixture is added.

After having been mordanted in this manner, the yarn is wrung off well, straightened and dried, and after drying, the same treatment is repeated.

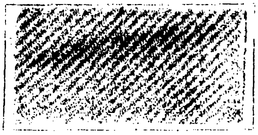
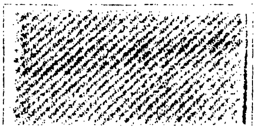
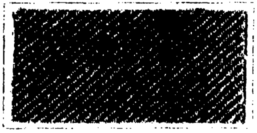
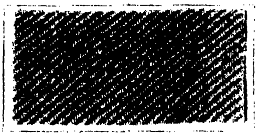
The dyeing is carried out in a cold concentrated bath with the addition of some acetic acid, whilst the colour solution is added in two or three portions.

It is important for the production of level shades to wring off the yarn as evenly as possible and to mordant it twice or three times with Turkey-red oil.

A Tabular Survey of the Basic Dyestuffs

and of their Properties and Fastness.

Regarding the classification into degrees of fastness, "IV" denotes the highest and "I" the lowest standard. The fastness to light of Indigo thus corresponds with "IV", whilst the fastness of Congo Red is expressed by "I".

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
Thioflavine T pat. 1%  3% 	Thioflavine T is very fast to washing and resists alkaline soaping rather well.	II.	Not fast to stoving.	Very fast to hot pressing. III—IV.
Paraphosphine G pat. 1% 3% 	The fastness to washing is not quite so good as that of Thioflavine T, the colours losing somewhat in depth.	II.	The shade is redder after rinsing.	IV.
Paraphosphine R pat. 1%  3% 	Same as with Paraphosphine G.	II—III.	Same as with Paraphosphine G.	IV.
New Phosphine G pat. 1% 3% 	Not so good as Paraphosphine G; the dyeings stand only slight soaping.	III.	The shade is altered a little more than that of Paraphosphine G.	IV.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs.	Remarks
Thioflavine T stands a weak chloring very well.	The colours stand cross-dyeing in an acid bath very well without staining the wool.		*Owing to its exceedingly bright greenish yellow shade, Thioflavine T belongs to the most important yellow dyestuffs. Its dyeings are very fast to washing and light as well as to acids. Thioflavine T is extensively used in the printing trade, where its good fastness to chloring is of special advantage, also for the production of bright yellow and greenish yellow shades on yarns and piece-goods.*
Not fast to chloring.	Similar to Thioflavine T, but the wool is stained slightly yellowish.		*The two Paraphosphines are used for deep yellow shades and for shading orange and red colours dyed with basic dyestuffs.* *They serve also as cheap topping colours for brightening brown velvet dyeings.*
Not fast to chloring.	Same as with Paraphosphine G.		
Not fast to chloring.	The colours are not fast enough to acids to be serviceable for this kind of goods.		*New Phosphine G is not so much used for dyeing, but serves principally for printing cotton, unions and satins.*

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
Tannin Orange R pat. 1 % ■ 3 % ■	The colours lose in depth on washing with soap or soda, but for many classes of goods they may be considered fast to washing.	II—III.	After rinsing slightly redder.	IV.
Chrysoïdine F 1 % ■ 3 % ■	The colours are not fast to washing.	II.	After rinsing a little redder.	III.
Bismarck Brown GG 1 % ■ 3 % ■	Same as with Chrysoïdine.	I – II.	Relatively good in fastness to stoving.	III.
Tannin Brown B 1 % ■ 3 % ■	Same as with Chrysoïdine.	II.	After rinsing a little brighter.	III.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs	Remarks
Not fast to chloring.	The colours are not fast enough to acids to be serviceable for unions.	The dyestuff is sold both in powder and in paste form.	*Tannin Orange yields colours which are relatively very fast to light and washing. It is used on cotton mordanted with tannin for orange shades and in combination with Safranine for yellowish reds.*
Not fast to chloring.	Same as with Tannin Orange.	The following are the other most important commercial brands: Chrysoïdine crystals is the brand most entensively employed; Chrysoïdine F yields brighter, more yellowish shades; Chrysoïdine R is the reddest product and Chrysoïdine AG the most yellowish product of this group; Chrysoïdine FN has the best covering power.	*These dyestuffs are principally used for topping.*
Not fast to chloring.	Considerably faster to acids than Chrysoïdine, although only serviceable in exceptional cases for goods to be cross-dyed with acids.	The following brands of Bismarck Brown are on the market: Bismarck Brown GG is the brand most extensively employed; Bismarck Brown EE is the reddest brand; Bismarck Brown FF is a little clearer than EE; Bismarck Brown PS is a little more bluish than GG; Bismarck Brown FFG is the most yellowish brand.	
Not fast to chloring.	Same as with Chrysoïdine.		

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
Irisamine G pat. 1 % ■ 3 % ■	The fastness to washing is relatively good and the colours do not lose much in depth. White cotton washed with it is not stained.	II—III.	Not fast to stoving.	Very good. IV.
Safranine G extra 0 1 % ■ 3 % ■	The fastness to washing is very good and white cotton washed with it is very slightly tinged only if subjected to a severe alkaline soaping.	III.	After rinsing the shade appears very little altered.	IV.
Tannin Heliotrope 1 % ■ 3 % ■	Same as with Safranine.	III.	Good.	III.
Magenta Ia Diamond large cryst. ½ % ■ 1½ % ■	Not so good as Safranine; the colours will however stand washing with soap quite well.	I.	Not fast to stoving.	II.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs	Remarks
Not fast to chloring.	The colours become somewhat paler by cross-dyeing with acids, but for most goods the fastness to acids is sufficient.		*Irisamine is equal to the Rhodamines in fastness to light and washing and superior to them in its exceedingly bright bluish shade. In addition to its application in the printing trade, it is chiefly used for dyeing brilliant pinks on cotton.*
Not fast to chloring.	Not satisfactory.	The following important brands of Safranine are on the market: G extra O is the brand most generally employed; Safranine crystals is pure crystallised G extra O; Safranine GGS is the most yellowish Safranine; Safranine S 150 } Safranine G 140 } yield the same shade as G extra O but are more concentrated products.	*Safranine is still used in undiminished quantities for dyeing yarns and pieces. It is especially employed on yarns as a substitute for Turkey-red owing to its relatively good fastness to light and washing and to its shade resembling that of Turkey-red.* *For the production of yellowish red shades Safranine is combined with Thioflavine T or Tannin Orange, and for bluish reds with Tannin Heliotrope. The Safranines serve also for dyeing velvets, partly for the production of deep red colours and partly for topping.*
Not fast to chloring.	Somewhat better than Safranine, but hardly satisfactory.		*Belongs to the Safranines and possesses an equally good fastness to light and washing. Tannin Heliotrope is also employed for the same class of goods and differs from the Safranines only by its more violet shade.*
Not fast to chloring.		The members of the Magenta group are: Magenta Ia Diamond large and small crystals: Magenta yellow shade, which dyes a little more yellowish; Russian Red G and B, dyeing duller reds than Magenta; Geranium, a duller Magenta Red, dyeing more yellowish; Cerise, like Geranium, but dyeing more bluish.	*Magenta is chiefly used on account of its bright bluish red shade, partly on mordanted cotton and partly for topping.*

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
Methyl Violet 1 % **R** ■ 1 % **6 B** ■	The colours stand washing fairly well.	I.	Not fast to stoving.	III—IV.
Fast Neutral Violet B 1 % ■ 3 % ■	Better than Methyl Violet.	II.	The shade is a little brighter after rinsing.	IV.
New Methylene Blue 3R pat. 1 % ■ 3 % ■	Same as with Methyl Violet.	I—II.	Not fast to stoving.	IV.
New Methylene Blue R pat. 1 % ■ 3 % ■	Good in fastnes to washing with soap or soda, the shade turning a little more purple.	II.	Not fast to stoving.	III—IV.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs.	Remarks
Not fast to chloring.	The bluish brands, e. g. 6 B and 3 B, stand cross-dyeing with acids well and the wool is but slightly tinged.	Methyl Violet 4 R is the reddest and Methyl Violet 6 B the most bluish brand.	*Like Magenta it is still rather extensively used on account of its particularly bright shade, both on mordanted cotton and for topping.*
Not fast to chloring.	Not fast to acids.		*Fast Neutral Violet B, though less bright than Methyl Violet, is superior in fastness to light and washing.*
Not fast to chloring.	The colours are fast to acids, and in cross-dyeing with acids the wool is less stained than is the case with Methyl Violet.		*Both products are used for bright navy blue shades, both on mordanted cotton and for topping Diamine Colours.*
Not fast to chloring.	Good.		

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
New Methylene Blue N pat. 1 % ■ 3 % ■	New Methylene Blue N is very fast to washing; the colours stand normal washing with soap or soda well.	IV.	The shade becomes a little brighter after being well rinsed.	III.
New Methylene Blue GG pat. 1 % ■ 3 % ■	Almost equal to New Methylene Blue N.	IV.	Same as with New Methylene Blue N.	III.
New Blue 3 % **R** ■ 3 % **FL** ■	The colours stand washing with neutral soap very well. By washing with soda the shade is altered.	IV.	Same as with New Methylene Blue N.	IV.
Metaphenylene Blue pat. 3 % **B** ■ 3 % **RJ** ■	Very fast to washing; the shade becomes but little paler.	III.	Fairly fast to stoving.	IV.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs	Remarks
Not fast to chloring.	The shade remains unchanged when cross-dyed with acids, and the wool is only very slightly stained.	The following important brands are on the market: New Methylene Blue N is the principal brand; New Methylene Blue GB is a little greener than N; New Methylene Blue NX is similar to N; New Methylene Blue NSS is New Methylene Blue N free from zinc.	*New Methylene Blue N is one of the most extensively employed basic dyestuffs and is used both for yarns and piece-goods as well as for dyeing loose cotton.* *This extensive application is due to its bright deep blue shade which is very fast to light and washing. It is also very much used in combination with Diamine Colours for brightening purposes.*
Not fast to chloring.	New Methylene Blue GG is still better than N as regards cross-dyeing with acids, the wool not becoming tinged.		*New Methylene Blue GG dyes more greenish blue shades than N which are equally fast to light and washing and like the latter are used both on mordanted cotton and for topping.*
Not fast to chloring.	Not fast enough to acids.	The following are the principal brands on the market: New Blue R is the brand most extensively employed, New Blue G dyes more greenish shades; New Blue D 120 dyes a bright reddish blue shade; New Blue FL L } dye purer and brighter shades than the above brands.	*New Blue formerly belonged to the most generally employed basic dyestuffs, but has more recently been largely replaced by Indazine, Metaphenylene Blue, Methylindone and Naphtindone, these being faster to washing. It still finds large application for the production of Indigo shades by topping and in printing.*
Not fast to chloring.	Very fast to acids.	The following brands of Metaphenylene Blue are on the market: Metaphenylene Blue B is the principal brand; Metaphenylene Blue BB dyes brighter shades; Metaphenylene Blue BBR dyes more purplish shades; Metaphenylene Blue RJ is the reddest brand.	*Metaphenylene Blue is used for the production of Indigo shades and chiefly finds application for previously mordanted yarns and piece-goods.*

Name of the Colour	Fastness to Washing	Fastness to Light	Fastness to Stoving	Fastness to Hot Pressing
Indazine M pat. 1 % ■ 3 % ■	Indazine M similarly to New Methylene Blue is very fast to washing.	III.	After rinsing a little redder.	IV.
Naphtindone BB pat. 1 % ■ 3 % ■	The colours are exceedingly fast to washing, and only boiling with strongly alkaline lyes turns the shade more violet.	III—IV.	After rinsing a little redder.	IV.
Methylindone pat. 3 % **B** ■ 3 % **R** ■	The colours possess the same excellent fastness to washing as Naphtindone and are not altered in shade even by strong alkaline soaping.	B: IV. R: III—IV.	After rinsing a little redder.	IV.
Brilliant Green and **Solid Green** 1 % **Brilliant Green** ■ 1 % **Solid Green** ■	The colours resist washing with soap very well, and only by washing with soda do they turn much paler.	I.	Not fast to stoving.	III—IV.

Fastness to Chloring	Fastness to Acids with regard to Cross-dyeing	Other brands of the same group of dyestuffs	Remarks
Not fast to chloring.	Good fastness to acids.	The following important brands of Indazine are on the market: Indazine M is the brand most extensively employed; Indazine GB dyes a greenish blue; Indazine L and P dye deeper shades and have more covering power.	*Indazine M is distinguished by its especially good fastness to washing and is extensively employed for yarns and piece-goods. It also serves very well for topping. In order to diminish the brightness of the shade, the colour is frequently saddened by an aftertreatment with iron liquor.*
Resists weak chloring.	Very good fastness to acids.	Naphtindone BB is the brand most extensively employed; it is sold both in powder and in paste; Naphtindone BR is a little more violet in shade; Naphtindone T yields darker shades than BB.	*Amongst the basic dyestuffs Naphtindone is the best substitute for Indigo, the dyeings resembling Indigo shades very closely both in aspect and reflex and being also exceedingly fast to light, washing and acids. Naphtindone is very extensively employed both on a mordant of sumac and antimony and on goods previously bottomed with Diamine Colours.*
Not fast to chloring.	The colours become a little lighter when cross-dyed with acids.		*Methylindone serves chiefly for imitating pale Indigo shades and belongs to the best basic dyestuffs as regards fastness to light and washing.*
Not fast to chloring.	The colours become a little lighter when cross-dyed with acids, and the wool is strongly coloured.	Malachite Green is the double chloride of zinc of Solid Green.	*Both these dyestuffs serve for the production of the well-known brilliant green shades on cotton yarns and piece-goods.*

D. Paranitraniline Red.

Paranitraniline, on account of its simple method of dyeing and its excellent properties of fastness, is continually gaining in favour as a substitute for Alizarine Red.

The dyeings are distinguished by their good fastness to light, excellent fastness to washing, chloring and acids, and are in no way inferior to Alizarine Red in fastness to rubbing, especially in the case of piece-goods.

Whilst Paranitraniline Red yields excellent results both on yarns and on piece-goods, it is not much used on loose cotton, level dyeings being difficult to obtain on this material.

The method of dyeing yarns and piece-goods is described under the respective headings.

We may add that Paranitraniline can in all cases be replaced by Nitrazol C, the process of dyeing being considerably facilitated by the application of the latter in so far as the operation of diazotising is thereby avoided.

E. Acid Dyestuffs.

(Scarlets, Eosines, Soluble Blues.)

Acid dyestuffs are used on cotton principally for bright shades which are not required to be fast to washing.

A. Scarlets.

Brilliant Croceïne M, R, B to 9 B.
Scarlet FR, FRR, FRRR.
Croceïne AZ.

Amongst these the Croceïnes are especially important, as they yield brilliant scarlet shades of excellent fastness to light; their resistance to washing however is very poor.

Method of dyeing.

The quantity of dye-liquor should be as small as possible (not more than 10 parts of liquor to 1 part of yarn). The bath is prepared with the requisite quantity of colouring matter and about:

$\left.\begin{array}{l}\text{5 oz. alum and}\\ \text{2 lbs Glauber's salt}\end{array}\right\}$ per 10 gallons of liquor.

The quantity of colour to be used depends on the depth of the shade to be obtained. As the dye-liquor is not exhausted, the additions for the first lot must be considerably larger than those for subsequent lots.

Brilliant Croceïne M for instance is dyed as follows:

For deep shades:

Ist lot:	IInd and following lots:
10 % Brilliant Croceïne M	2 % Brilliant Croceïne M
3 % Alum	3/4 % Alum
20 % Glauber's salt.	5 % Glauber's salt.

For medium shades:

Ist lot:	IInd and following lots:
5 % Brilliant Croceïne M	1 1/2 % Brilliant Croceïne M
3 % Alum	3/4 % Alum
20 % Glauber's salt.	5 % Glauber's salt.

For light shades:

Ist lot:	IInd and following lots:
3 % Brilliant Croceïne M	1/2 % Brilliant Croceïne M
2 % Alum	1/2 % Alum
10 % Glauber's salt.	3 % Glauber's salt.

The cotton is entered at 120°—140° F and turned for half an hour, whilst the bath is cooling off. The cotton is then evenly wrung and, without rinsing, dried at a moderate temperature.

The rest of the Croceïnes and Scarlets are dyed in the same way.

B. Eosines.

Eosine 3G, GGF, BN.
Eosine Scarlet B.
Erythrosine yellow shade, extra N, B, D.
Phloxine (749).
Rose Bengale extra N.
Irisamine G.
Rhodamine B.

These dyestuffs yield still more brilliant shades than the Croceïnes, but are inferior to them in fastness to light.

Method of dyeing:

The cotton is dyed for half an hour in a concentrated bath at 85° — 105° F with addition of 4—5 lbs of salt per 10 gallons of liquor, and then dried without rinsing. It is important that not more dye-liquor than necessary (at the utmost 10—12 gallons of water for 100 lbs of cotton) is used.

The first bath must be amply charged with dyestuff, for deep shades with 8—10 %, whilst for the following lots in the same bath additions of 1½—3 % are sufficient. The addition of salt to the standing baths may also be reduced to 15—20 % of the weight of the cotton to be dyed.

The cotton must be dried at a moderate temperature.

Rhodamine B and Irisamine G may also be dyed on yarn mordanted with Turkey-red oil as described on page 150, in which case they yield exceedingly brilliant pink shades.

E. Soluble Blues.

Water Blue B, RB, R
Pure Soluble Blue
Methyl Blue for Cotton
Blue JBP, JB, BS, FS, RS, RRS
Alkaline Blue RRR to 6B.

Method of dyeing:

1. Direct dyeing with alum and Glauber's salt.

These dyestuffs are dyed exactly as described for the Croceïnes on page 167, only half as much colouring matter, however, being required. The additions of alum and Glauber's salt remain the same.

2. Dyeing on tannin mordants.

The dyestuffs are dyed on tannin mordants exactly as described for basic dyestuffs and yield then very bright colours, which though faster to washing than those dyed by the first method, cannot even then be termed practically fast to washing.

The Alkaline Blues especially are dyed according to this second method.

F. Combinations of various Dyestuffs.

Topping Diamine and Immedial Colours with Basic Dyestuffs.

The dyes produced with Diamine Colours either by direct dyeing or by developing possess the property of taking up and fixing the basic dyestuffs. This property may be made use of for brightening or shading such dyes with suitable basic dyestuffs.

In the same advantageous way basic dyestuffs may be fixed on dyeings produced with Immedial Colours.

The topping is always effected in a fresh bath containing the solution of the basic dyestuff and an addition of 2—5 % acetic acid or 1—3 % alum (of the weight of the cotton). The dyeing is done cold or lukewarm, and in the case of such basic dyestuffs which have a great affinity to the cotton the precaution is taken to turn the material several times in the liquor, which has been previously charged with alum or acetic acid only, subsequently adding the colour solution in two or three portions.

For piece goods the topping has the special advantage of better covering the impurities (such as fragments of straw, dead cotton etc.) always present in low class goods.

In order to obtain fast shades by topping Diamine Colours, the topping must be preceded by the usual mordanting process with tannin and antimony.

Combinations of Diamine Colours with Oxydation-Black.

This method in addition to being reliable in its results has the advantage that the cotton is subject much less to tendering than in the case of pure Aniline Black.

The cotton is either

1) dyed a light shade with Diamine Colours and topped with a strong aniline liquor

or

2) heavily bottomed with Diamine Black and topped with correspondingly less Aniline Black.

Example for 1)

Dye with $1\frac{1}{2}$—2 % Diamine Jet Black SS
or any other brand of Diamine Jet Black
with the addition of 15 % Glauber's salt, rinse, hydro-extract and work in the following aniline liquor:

Dissolve:

3 lbs. chlorate of soda in
3 galls. water and
8 lbs. aniline salt in
$1\frac{1}{2}$ gall. boiling water;

mix the two solutions, when cooled off, and add

$4\frac{1}{4}$ oz. bluestone dissolved in
3 pints water and
7 pints acetate of alumina 15° Tw.*)

This yields about 6 galls. aniline liquor 12° Tw. which is diluted to $8\frac{1}{2}$° Tw. by adding about $1\frac{1}{2}$ gallon water.

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*) Acetate of alumina 15° Tw. is prepared by mixing
10 lbs. alum in $1\frac{1}{2}$ gallon boiling water with
11 lbs. sugar of lead in $1\frac{1}{4}$ gallon boiling water
and allowing to settle. The clear solution is drawn off for use.

The cotton being impregnated with this liquor, is pressed off well or hydro-extracted and brought into the warm ageing room which should be 85 ° F; as soon as the ageing is completed the cotton is passed through a cold bath, containing per 100 galls. water

1/4 lb. bichromate of potash
1/2 lb. sulphuric acid 167 ° Tw.

The cotton is then washed and soaped or, better, oiled.

For bluer shades the treatment with bichrome and sulphuric acid is better omitted.

Example for 2)

Dye with

3 1/2—4 % Diamine Jet Black SS

as described sub 1) and top with an aniline liquor 4 1/4 ° Tw., obtained by adding

about 7 galls. of cold water to
4 galls. of the above aniline liquor 12 ° Tw.

Otherwise work as described above.

The Diamine Colour is simultaneously fixed, fast to washing, by the topping with Aniline Black.

A special kind of goods — black cotton with shots of white wool — is produced by bottoming with Diamine Black and topping with Oxydation-Black.

The pieces are bottomed in the jigger with

9 1/2 oz. Diamine Black 31
13 „ soap
1 lb. Glauber's salt per 10 gallons of liquor

at a temperature of about 85 ° F.

The material is then washed very well, dried and padded with an Aniline-Oxydation-Black liquor of about half the strength of the usual aniline liquor.

After drying and ageing, the pieces are gently chromed and very well soaped.

Diamine Colours and Immedial Colours for bottoming One-bath Aniline Black.

A. Diamine Colours.

The cotton is bottomed as usual for deep blacks with about 3½ % Oxydiamine Black or Diamineral Black B, and for bluish blacks with about 3½ % Diamineral Blue R (4½ % in the starting bath) with the addition of

2 % soda ash and } of the weight
30 % Glauber's salt } of the cotton,

and after one hour's dyeing at the boil and good wringing or hydro-extracting it is brought into the aniline bath.

Topping with One-bath Aniline Black for 100 lbs. of cotton.

The bath is prepared with the requisite quantity of water and

4 lbs. aniline salt
6—7 „ hydrochloric acid 30° Tw.
3 „ sulphuric acid 168° Tw.

and subsequently with solutions of

3 lbs. bluestone and
4 „ bichromate of soda.

The cotton is worked one hour in the cold bath, which is then heated slowly within about ½ hour to 120—140° F.; after this the material is lifted, washed and soaped (with about 3 oz. of soap per 10 gallons of liquor).

In the case of loose cotton about 5 lbs. of aniline salt for every 100 lbs. of cotton should be used; otherwise the same quantities as for yarns should be taken.

Notes.

As long as the cotton is worked in the cold, the aniline bath must not contain any more water than absolutely necessary (about 10—14 times the weight of the cotton). Only when the heating begins the quantity of the liquor must be increased to 18—20 times the weight of the cotton.

Should the black come out too greenish, the cotton must be soaped in a stronger soap liquor or some soda be added to the soap bath; if the black, however, be too reddish, it is soured off with 1—2% acetic acid after washing and soaping. Oiling of the goods, as frequently done, is not advisable, the fastness to rubbing thereby being diminished.

B. Immedial Colours.

The combination of Immedial Black with One-bath Aniline Black is chiefly advantageous, if weighting of the cotton be required, a somewhat heavier weighting being obtained by topping Immedial Black with One-bath Aniline Black than with Immedial Black alone.

Immedial Black is dyed for this purpose as described for yarns and loose cotton, only half as much of the colouring matter and the other ingredients, however, being used as for Immedial Black alone.

After dyeing and squeezing, the cotton is rinsed and then topped with Aniline Black as stated on the preceding page.

Combination of Indigo with Diamine Colours, Immedial Colours and Basic Dyestuffs.

A. Diamine Colours.

The Diamine Colours are used both for bottoming and for topping vat blues, whereby very much Indigo is economised and the material is better dyed through. Particularly linen yarns, linen pieces and other tightly woven materials are bottomed, as they are not satisfactorily penetrated by Indigo alone.

All black and dark blue Diamine Colours may be used for bottoming. Most extensively employed are Diamine Jet Black SS, Diamine Black RO and Diamine Black BH. In a few cases Diamine Brown V is also used for the production of coppery shades.

The goods are for example bottomed with:

1½% Diamine Black RO
½% Diamine Brown V

with the addition of

2% soda ash
5% Glauber's salt

and then dyed in the Indigo vat.

For topping Indigo shades, principally blue and violet Diamine Colours are used, especially Diamineral Blue R, Diamine Fast Blue C and Diamine Violet N, all of which possess very good fastness to light and washing.

B. Immedial Colours.

Apart from Immedial Black, Immedial Blue C and CR as well as Immedial Direct Blue B have given the most satisfactory results for bottoming Indigoes.

The bottoming with *Immedial Black* is chiefly employed for dark shades and is done by dyeing first with 2—5 % Immedial Black, this colour being subsequently topped in the Indigo vat.

In bottoming with *Immedial Blue*, Immedial Blue C is used for light shades and Immedial Blue CR for deeper and more violet shades.

As a rule Immedial Blues are not steamed when applied for such bottoming purposes, however, this depends in the first instance on the shade to be produced and on the kind of vat employed.

For topping in the *hydrosulphite vat* the previous steaming may be dispensed with both for pale and for dark shades.

If the topping be done in the *zinc dust lime vat*, pale shades will come out brighter, if steamed before topping, whilst for medium and dark shades steaming is unnecessary.

If the colour be topped in the copperas-lime vat, it is advisable to steam previously, as this process renders the colours much brighter.

It is of no consequence whether the goods be washed before the topping or be brought unwashed into the vat; it is, however, of great advantage to leave the goods unwashed for 2—3 hours after having been topped in the vat, and to sour them off and wash them subsequently.

After dyeing piece goods with Immedial Blue they are frequently left unwashed and well covered with felting for 12—24 hours and then dyed in the vat.

In many cases yarns are first dyed in the vat and subsequently topped with Immedial Blue. Dyeing and steaming of Immedial Blue is then done exactly as described for this colouring matter.

Immedial Direct Blue B may be applied in the same way as Immedial Blue for bottoming Indigo with the advantage that it can be used for all sorts of vats directly without developing by steaming. It is dyed to a depth of 2—5%, washed and then topped with Indigo.

C. Basic Dyestuffs.

The basic dyestuffs are used in combination with Indigo only for topping the same and serve principally for brightening. Frequently, however, their application is even necessary in order to better cover the burls of cotton piece goods which are not well enough dyed by Indigo.

For this purpose, especially the various brands of New Methylene Blue, such as N, R and 3 R and also Indazine M and Naphtindone B B are used.

The dyeing is effected exactly as described on page 173 and in few cases only the Indigo-dyed goods are mordanted with tannin and tartar emetic before being dyed with basic dyestuffs, in order to obtain greater fastness; in the latter case they should be dyed according to the method described on page 145.

Combination of Diamine Colours with Logwood.

A simple method to evade the chief drawback of logwood colours — their absolute lack of fastness to acids — consists in a combination of one-dip logwood with Oxydiamine Black A or Diamine Jet Black SS.

The following proportions yield good results:

The goods are dyed for one hour at the boil with

3% Oxydiamine Black A
9% Logwood Extract
10% Glauber's salt,

left for some hours or over night in contact with the air and then brought into a cold bath of pyrolignite of iron of 1—2° Tw. containing 1/2 lb chalk per 10 galls. of liquor; they are worked in this bath for about 1/2 hour and then well washed.

Copperas may also be used instead of pyrolignite of iron.

The fixing is effected exactly as for logwood black. It must only be observed, that no bluestone nor any other metallic salt be added to the Oxydiamine Black dye-bath.

To the bath of pyrolignite, however, bluestone may be added; but for this black, copper salts are not required at all.

The fastness to milling of the black thus produced is not so good as that of logwood dyes, but sufficient in most cases. The fastness to acids is considerably greater than that of pure logwood blacks.

If Diamine Jet Black SS is used in place of Oxydiamine Black along with logwood, the fastness to light of the colours increases considerably.

Topping Cutch Dyes with Diamine Colours.

As compared with the method formerly in use of topping cutch dyes with either basic or natural dyestuffs, the application of Diamine Colours for this purpose has the advantage of a simpler procedure with the result of yielding dyes faster to washing and rubbing.

The dyestuffs which are chiefly used are:

Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Yellow CP
Diamine Orange B*
Oxy Diamine Brown G
Diamine Catechine G*
Diamine Catechine 3G*

for yellowish brown shades

and

Diamine Brown M*
Diamine Brown B*
Diamine Jet Black SS*
Diamineral Black B*
Diamineral Black 3B*
Diamineral Black 6B*

for dark brown shades.

The dyestuffs marked with an asterisk * may be fixed fast to washing by an aftertreatment with bichrome and bluestone (see page 67).

I.

A. The Dyeing of Loose Cotton.

B. The Dyeing of Loose Cotton, Sliver and Roving in Dyeing Machines.

The Dyeing of Loose Cotton.

Diamine Colours.

- Direct Dyeings.
- Dyeings aftertreated with Metallic Salts.
- Diazotised and Developed Dyeings.
- Coupled Dyeings.

Immedial Colours.

- Immedial Black.
- Immedial Direct Blue.
- Immedial Sky Blue.
- Immedial Blue.
- Immedial Brown and Immedial Bronze.
- Grey and Mode Shades with Immedial Colours.

Combinations of Diamine Colours or Immedial Colours with One-Bath Aniline Black.

Dyeing with Basic Dyestuffs.

Topping with Basic Dyestuffs.

Softening Loose Cotton.

The Dyeing of Loose Cotton, Sliver and Roving in Dyeing Machines.

Diamine Colours.

- Direct Dyeings.
- Dyeings aftertreated with Metallic Salts.
- Diazotised and Developed Dyeings.
- Coupled Dyeings.

Immedial Colours.

Immedial Black.
Immedial Direct Blue.
Immedial Sky Blue.
Immedial Blue.
Immedial Brown and Immedial Bronze.

Basic Dyestuffs.

Topping with Basic Dyestuffs.

Production of the Principal Shades on Loose Cotton.

Dyeing Diamine Colours on Loose Cotton.

Diamine Colours are very extensively used for dyeing loose cotton and their application for this purpose is continually increasing owing to the prominent advantages gained thereby.

The following advantages may be specially mentioned:

1) Simplicity of working, one hour's dyeing being sufficient in most cases.
2) The softness and spinning properties of the cotton are perfectly preserved; hence the dyed cotton may be spun to the same fineness as the raw cotton without any appreciable waste being produced.
3) The carding of the cotton is very much facilitated and consequently there is very little wear of cards.

Most of the Diamine Colours yield, even by direct dyeing, dyes of good fastness to washing, which especially in *pale shades* satisfy most demands. The direct dyed *dark shades* are also satisfactory for many purposes, especially if the colours are not milled together with white cotton. If, however, the demands in regard to fastness to milling are more exacting, the colours must be fixed on the fibre to improve their fastness to washing, this being obtained

either by Metallic Salts, or
by Diazotising and Developing, or
by Coupling.

Direct Dyeings with Diamine Colours.

The Diamine Colours are dyed in the most simple manner in large vats, made of wood, copper, or iron, and heated, if possible, with indirect steam. Copper pans are best used in the well known shape of steam-jacketed vessels.

The dye-bath is charged:

for pale shades with 2 % soda ash and 10 % Glauber's salt
or
2 % soap and 5 % phosphate of soda;
for dark shades with 2 % soda ash and 20 % Glauber's salt
or
2 % soda ash and 30 % common salt.

After the dye-liquor has been brought to the boil, the dry, previously opened, cotton is entered and boiled about ¾—1 hour with the usual poling.

The dye-liquors are almost entirely exhausted in the case of pale shades, and for dark shades only it is sometimes desirable to preserve the baths for further use. In order to exhaust the baths as well as possible they should be kept very concentrated and the cotton be allowed to feed in the cooling liquor. The quantity of liquor should amount at the utmost to 18—20 times the weight of the cotton to be dyed.

After dyeing, the cotton is thrown out; having cooled off for some time it is rinsed.

We may here state that it is not advantageous to leave the cotton unrinsed for a long time or over night, as the colours cannot thereby increase in intensity, but the shade of those parts may change which have been exposed too long to the air. Well rinsed cotton may, however, remain exposed in its wet state for a prolonged time.

Frequently the cotton is not rinsed at all after dyeing, but simply sprayed in the hydro-extractor and then dried.

For shading in the warm dye-liquor the dyestuffs recommended for this purpose on page 10 will render excellent service.

Dyeings aftertreated with Metallic Salts.

The aftertreatment with metallic salts is applied to loose cotton chiefly in order to produce dyes of increased fastness to light and washing.

The dyestuffs suitable for this purpose and the various methods of aftertreatment are described on page 65.

The dyeing proper is done exactly as with the direct colours. After dyeing, the liquor is let off and the cotton lightly rinsed and aftertreated in the same vat or pan, or the dyed cotton is entered into a separate bath prepared for the aftertreatment as described on pages 66—68.

If the solutions of metallic salts be used continuously, only two thirds or one half of the quantities used for the first bath are required for the following charges.

Diazotised and Developed Dyeings.

The process of diazotising and developing serves chiefly for the production of colours very fast to washing.

The dyestuffs suitable for diazotising and developing have been enumerated on page 85.

The dyeing proper is done exactly as described above for the direct colours.

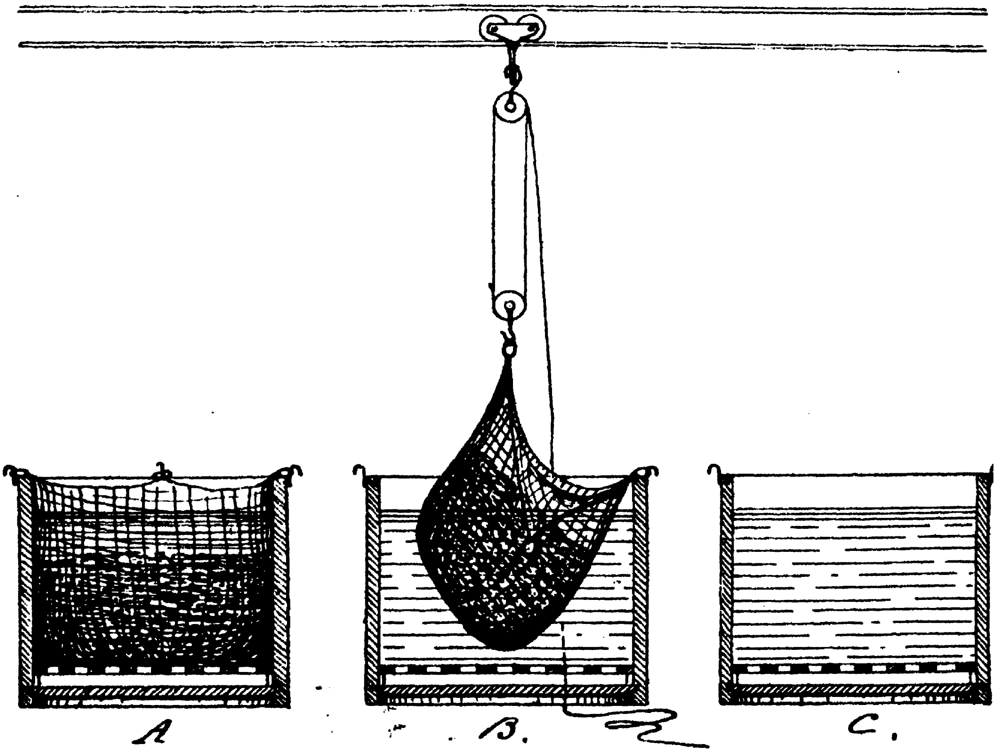
After dyeing, the cotton is first rinsed in cold water and then diazotised and developed. The method of diazotising and developing has been stated on page 86.

The process can be carried out in various ways.

a) After rinsing, the cotton is brought first into a vat containing nitrite and hydrochloric acid, worked therein for 15 or 20 minutes, lifted, brought into another vat filled with acidulated water, turned again for a short period and brought into a third vat prepared with the developing liquor. The cotton remains in this bath for about 20 minutes, is then taken out and washed in water.

All liquors are used cold, and care should be taken that the cotton is no longer warm when brought into the diazotising bath.

b) The working is the same as described under a) with the difference, however, that smaller lots are diazotised and developed and a perforated false bottom or a net, e. g. as shown in the following sketch, is used to transfer the material from one bath into the next.



The dyed cotton is rinsed and hydro-extracted and then placed into a net which can be lifted and lowered by means of a travelling crane arranged above the vats.

The first vat A is filled with nitrite and hydrochloric acid, the second vat B contains water acidulated with hydrochloric or sulphuric acid and the third vat is charged with the developing solution.

The cotton remains in A and C 15—20 minutes each time, in B only a short while, is well turned each time, lifted, lowered after draining into the next bath and finally rinsed.

c) The ordinary washing machine is also frequently used for diazotising and developing. The dyed cotton is first rinsed in the same, and then nitrite and hydrochloric acid are added, whilst the cotton is turned for about 15 minutes. The liquor is then run off and replaced by fresh water which is acidulated with some hydrochloric acid. The cotton is again rinsed for a few minutes and finally turned for about 15 minutes in a fresh liquor charged with the developer.

d) For large establishments the following arrangement has proved very satisfactory:

Below the dye vat three reservoirs are let into the ground, of which the middle one which is directly under the dye vat serves for keeping the dye-liquor and those on each side for the diazotising and developing liquors. After dyeing, the dye-liquor is run off into the middle reservoir and the cotton rinsed cold. Subsequently, the diazotising liquor and after rinsing, the developing liquor, are pumped, each in their turn, over the cotton. The diazotising and the developing liquors are allowed to act for about 15 or 20 minutes each time.

Note:

The diazotising and developing liquors may be kept and used over again, in which case the requisite quantities are reduced to about three fourths of those indicated on page 89.

Coupled Dyeings with Diamine Colours.

The coupling process has come very largely into use especially for browns and blacks on loose cotton, as it yields colours very fast to milling by a very cheap and simple process.

The dyestuffs suitable for coupling have been enumerated on pages 111 and 112. — They are also dyed exactly as described for direct colours.

The coupling is most conveniently done in a wooden vat by rinsing the cotton after dyeing, or spraying it, until cold, in the hydro-extractor and then entering it into the coupling bath.

The coupling bath is prepared either with Nitrazol C or with diazotised Paranitraniline, as described on page 113, whereby the addition of soda ash or acetate of soda is omitted.

The solution of Nitrazol or Paranitraniline is prepared as stated on pages 112 and 113, but the charge of the bath is increased by one fourth of the quantities given there. The cotton must be turned rather quickly and thoroughly in the cold coupling bath for 20 or 30 minutes.

It is important for the production of level colours that the cotton be well poled, as the coupling may be imperfect in places, if the turning be insufficient.

After the coupling the cotton is rinsed and dried, or softened previous to drying.

The coupling bath being as a rule almost entirely exhausted need not be kept for further use.

Note:

In using the various processes of aftertreatment (diazotising, coupling or aftertreatment with metallic salts) the colours are matched to shade with the direct dyeings of which a pattern has been kept for reference. The various processes act every time alike, hence, when the shade of the direct dye has been once ascertained, the colour will always come out alike.

Dyeing with Immedial Colours on Loose Cotton.

The Immedial Colours yield dyes of eminent fastness to milling, acids and light and are exceedingly well adapted to the dyeing of loose cotton. The process of dyeing is most simple and it must only be observed that the dye-liquor should not come into contact with copper. Hence vats of wood or iron and steam coils of iron or lead are used.

Dyeing with Immedial Black.

For 100 lbs. loose cotton
in about 160 gallons of liquor.

First bath:	8	lbs.	soda ash
	14—16	„	cryst. sodium sulphide
	18—20	„	Immedial Black*)
	60	„	common salt**).

For dyeing subsequent lots in the old bath the following approximate quantities, calculated on the weight of the cotton, are added:

2 %	soda ash
8—10 %	cryst. sodium sulphide
10—12 %	Immedial Black*)
6— 8 %	common salt**).

*) The difference between the various brands of Immedial Black may be seen from the tables on page 136.

**) Glauber's salt may be used in place of common salt; 10 parts of the latter have the same effect as 12 parts of calcined or 24 parts of crystallised Glauber's salt.

The loose cotton is entered into the boiling dye-bath, poled for about 10 minutes, after which the vessel is covered up with a perforated lid and the cotton allowed to feed at the boil for $^1/_2$ hour.

The dyeing operation may be shortened if desirable by increasing the amount of dyestuff in the starting bath, whilst the other additions remain the same.

Care should be taken during the dyeing process to keep the cotton always well immersed below the surface of the liquor. Too diluted liquors must be avoided, or if the quantity of dye-liquor amounts to more than 160 or 180 gallons for every 100 lbs. of cotton the first bath must be prepared proportionately stronger.

The dyeing being completed, the cotton is lifted and the excess of liquor allowed to drain back into the dye vessel. The cotton is then well washed in the washing machine.

It is an excellent plan to pour cold water over the dyed cotton: by allowing this to run back into the dye-bath a good deal of the liquor otherwise remaining in the cotton is saved.

The cotton may also be taken straight from the dye-bath into the hydro-extractor, the extracted coloured effluent being collected and re-added to the dye-bath. It is best to use hydro-extractors made of iron. In order to avoid the detrimental action of the copper, some dye works have adopted the plan of lining the ordinary copper hydro-extractors with cotton cloth; it is preferable however to have them well tinned, a course which entails but small expense.

The final washing of the cotton may then take place as usual in the hydro-extractor or in a washing machine. In every case, however, it is essential that the cotton be thoroughly rinsed after dyeing.

For dyeing large quantities of cotton, reservoirs of the size of the dye-vat are sometimes arranged underneath the latter to receive the dye-liquor. Water is poured over the dyed cotton, allowed to drain into the reservoir and the final washing follows this first rinsing.

For dyeing a subsequent lot, the liquor is pumped back into the dye-vat and freshened up according to requirements as indicated above.

Aftertreatment.

In dyeing loose cotton *an aftertreatment is usually dispensed with.* Should such treatment, however, be required in order to increase either the intensity or to improve the appearance of the shade, the aftertreatment is effected by using bichrome only for blue blacks, and a mixture of bichrome and chrome alum for jet blacks, 3 % acetic acid being added in both cases.

The aftertreatment need not last longer than 20—25 minutes and should not be carried out at a temperature exceeding 160 to 175 ° F.

The aftertreatment may also take place in the washing machine, in which case a temperature of 105—120 ° F. will be sufficient.

The bath used for the aftertreatment *must remain perfectly clear;* any precipitate which may be formed is easily brought into solution again by adding a little more acetic acid.

If the loose cotton is not to be softened, it should be taken finally, before drying, through a short rinsing bath, containing 3 to 5 oz. acetate of soda per 10 gallons of liquor, and then be dried without again rinsing.

Dyeing with Immedial Direct Blue.

Immedial Direct Blue is dyed in the same way as Immedial Black.

For 100 lbs. cotton in about 160 gallons of liquor.

First bath:	2 %	soda ash
	4—12 %	cryst. sodium sulphide
	4—12 %	Immedial Direct Blue B
	8—24 %	common salt.

For dyeing subsequent lots in the old bath:

½—1 %	soda ash
4—10 %	cryst. sodium sulphide
4—10 %	Immedial Direct Blue B
2— 6 %	common salt.

Dye for about 1 hour in a hot bath, then throw the cotton into skeps or on to laths, so that the liquor may drain back into the dye-vessel, wash, soap and dry. The colour will become brighter in shade by allowing the cotton to remain unwashed for a couple of hours after hydro-extracting.

The shade also becomes brighter by an aftertreatment with:

1 %	sulphate of copper
1 %	bichrome
3 %	acetic acid.

The means most generally used for brightening consists in slightly topping with basic dyestuffs which may be done in the washing machine itself.

Dyeing with Immedial Sky Blue.

Immedial Sky Blue on loose cotton is not dyed, as otherwise usual, in a hot bath, but lukewarm or cold; nor is it necessary to wet or boil the cotton previous to dyeing, since Immedial Sky Blue penetrates the cotton very evenly in a cold bath.

Charge for the first bath (containing water equal to 20 times the weight of the cotton):

	for pale	for medium	for dark shades:
Immedial Sky Blue	1—10 %	10—20 %	20—30 %
cryst. sodium sulphide	1— 5 %	5—10 %	10—15 %
soda ash	5 %	5 %	5 %
Turkey-red oil	2 %	2 %	2 %
common salt	2—20 %	20—40 %	40—60 %

The dye-bath is imperfectly exhausted, about one half of the colouring matter remaining in the liquor. Consequently, for dyeing subsequent lots in the old bath, about the following quantities are to be taken, which represent also the quantities actually taken up by the fibre:

Additions for dyeing in the standing bath:

	for pale	for medium	for dark shades:
Immedial Sky Blue	$^1/_2$—5 %	5 — 9 %	9—13 %
cryst. sodium sulphide	$^1/_2$—2$^1/_2$ %	2$^1/_2$— 5 %	5— 7$^1/_2$ %
soda ash	2 %	2 %	2 %
Turkey-red oil	$^1/_2$ %	$^1/_2$ %	$^1/_2$ %
common salt	1—5 %	5—10 %	10—20 %

To begin with, one half of the indicated quantity of soda is added to the cold dye-liquor, then the hot colour solution (prepared according to the directions on page 123) and finally Turkey-red oil and salt. After the liquor has been heated to 95—105° F., the dry cotton is entered and worked for $^1/_2$—$^3/_4$ hour, when it is whizzed, which is best done in a hydro-extractor of iron or tinned copper. The cotton is then allowed to lie in heaps for $^1/_2$ to 1 hour and is hereafter well rinsed and, if so required, finally aftertreated with:

1$^1/_2$ %	sulphate of copper
1$^1/_2$ %	bichrome
3 %	acetic acid.

Dyeing with Immedial Blue C and CR.

The dyeing is carried out similar to the method described under Immedial Black, viz. by boiling for about 10 minutes and allowing to exhaust in the hot liquor.

For 100 lbs. loose cotton in 160 gallons of liquor

the first bath is prepared with:

3—4	lbs.	caustic soda lye 75° Tw.
10—20	,,	cryst. sodium sulphide
10—20	,,	Immedial Blue (according to the depth of shade)
10—20	,,	common salt.*)

For subsequent lots are added:

1—1½	%	caustic soda lye 75° Tw.
5—12	%	cryst. sodium sulphide
5—12	%	Immedial Blue
4—6	%	common salt.*)

During the dyeing process the cotton should be constantly kept below the surface of the liquor. This is best accomplished by weighing it down with a perforated lid.

After dyeing, the cotton is lifted so that the superfluous liquor may drain into the dye-vessel; it is then well hydro-extracted (best in an extractor of iron or tinned copper) and steamed *without previous rinsing*.

Steaming the loose cotton.

Loose cotton is best steamed in a wooden chest in which it is placed in layers on frames.

The method of introducing both steam and air has been described on page 130. The cotton is steamed as there indicated for about ½ hour, then rinsed in warm water, softened and dried.

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*) See note on page 193.

Instead of steaming, the developing may also be effected by *smothering* the moist cotton in a warm place.

The method of working is as follows:

The cotton is dyed as described above and then hydro-extracted without rinsing. While still warm it is packed into skeps, the inside of which is lined with oiled brown paper or "American cloth". The skeps are well covered so as to prevent the contents from cooling or drying, and placed for a few hours or over night into the drying room.

The blue develops best in this way, if the temperature of the drying room is somewhere about 140—160° F.

Other receptacles may also be used in place of skeps, provided care is taken to prevent the cotton from becoming partially dry at the sides, and that it retains its heat for a couple of hours.

The cotton is finally taken out of the skeps and rinsed as usual.

Note:

In order to match Immedial Blue dyes, an undeveloped pattern is passed through diluted acetic acid or a weak solution of alum and kept without being rinsed again. This pattern serves for matching subsequent lots before developing.

The influence of the steaming being always exactly the same, it is sufficient to match the undeveloped dyes.

The treatment with acetic acid or alum ensures the stability of the undeveloped colour.

Dyeing with Immedial Brown and Immedial Bronze.

The dyeing of the various brands of Immedial Brown and Immedial Bronze is carried out in a similar manner as indicated under Immedial Black, smaller quantities of sodium sulphide, however, being required.

For 100 lbs. cotton in about 160 gallons of liquor.

First bath according to the depth of shade:

4— 8	lbs.	soda ash
4— 8	„	cryst. sodium sulphide
8—16	„	Immedial Brown
40—80	„	common salt.*)

For dyeing subsequent lots in the standing bath the following quantities calculated on the weight of the cotton are used:

1— 1½	%	soda ash
2— 5	%	cryst. sodium sulphide
6—12	%	Immedial Brown
6—10	%	common salt.

The details of dyeing are in other respects the same as for Immedial Black.

The dyeing is usually done direct without an aftertreatment. Still, it is important to know that deeper shades of a better resistance to light are obtained, if the dyes are aftertreated for half an hour at 175° F. with:

1% sulphate of copper
2% bichrome
3% acetic acid,

whilst an aftertreatment with Nitrazol C yields deeper, more yellowish shades. The working of this latter process has been described on page 192.

Grey and Mode Shades produced with Immedial Colours.

Pale shades are dyed in the same way as blacks or browns, less sodium sulphide, of course, being used in consequence of there being smaller quantities of colouring matter employed than for deep shades.

The dye-bath may be charged e. g. with:

3%	soda ash
3—4%	sodium sulphide
3—4%	Immedial Black, Immedial Brown or a combination of the various Immedial Colours.

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*) See note on page 193.

The cotton is dyed for about ½ hour in a warm bath and rinsed.

In this way all the Immedial Colours may be dyed also in combination. Some Diamine Colours like Diamine Fast Yellow B and Diamine Orange B may also be added to the dye-bath for shading purposes. (See also page 134.)

Pale Immedial shades are generally dyed without any after-treatment, the fastness to washing, light and acids of the direct dyes being already very satisfactory.

If an especially great fastness to light be desired, an after-treatment is recommended with:

1 % bichrome
1 % sulphate of copper
2 % acetic acid.

Combination of Diamine Colours or of Immedial Colours with One-Dip Aniline Black.

Either the various Diamine Colours named on page 176 or the Immedial Blacks may serve as bottoms for One-dip aniline black. The two groups differ in this connection only in so far as the fastness of the bottom of Immedial Black is, as a rule, rather greater; but the dyes bottomed with Diamine Colours are also satisfactory for normal requirements.

The topping with Aniline Black has been described on pages 176 and 177.

Dyeing with Basic Dyestuffs on Loose Cotton.

The application of the basic dyestuffs is restricted to the production of those exceptionally bright shades which cannot be obtained with either Diamine Colours or Immedial Colours.

The dyeing and mordanting has been described on page 145.

For most purposes, however, it is sufficient to use the basic dyestuffs for topping cotton which has been grounded with Diamine or Immedial Colours without any previous mordanting (see page 173).

Topping with Basic Dyestuffs.

The topping with basic dyestuffs is adopted, when dyeing loose cotton, chiefly for the production of bright shades. Both the direct and the coupled and aftertreated dyes of Diamine Colours and also the dyes produced with Immedial Colours possess great affinity for basic dyestuffs and are capable of rendering them very fast to washing.

The topping bath is prepared with the requisite colouring matter and 2—3 % alum or 2—3 % acetic acid (of the weight of the cotton), and the cotton is turned for some time in the cold bath, rinsed and dried.

The topping may also be carried out in the same manner in the washing machine.

Softening Loose Cotton.

Softening is applied to loose cotton for the purpose of rendering it supple and is chiefly intended for cotton to be employed for spinning carded yarns.

The softening is prepared by boiling

3 parts of oleïne
1 part of soap and
1 part of ammonia

in a barrel. The softening is done by adding the requisite quantity to the liquor in which the cotton is to be treated.

The Dyeing of Loose Cotton, Sliver and Roving in Dyeing Machines.

When dyeing loose cotton in machines the original softness and spinning properties of the fibre are perfectly retained and the working expenses remain considerably lower than in dyeing in open vessels.

Not only the dyeing, but also the aftertreatments may be carried out in dyeing-machines.

Whilst machines constructed of copper are to be preferred for Diamine Colours, machines of iron, lead or wood should be used for Immedial Colours, since copper vessels cannot be employed. Dyeing machines made of nickel or nickel-plated iron, the cost of which is but little higher than those of iron machines, may be used with advantage for dyeing with both Diamine and Immedial Colours.

Dyeing in mechanical apparatus is very simple. It is of primary importance, however, to work with soft water, as free from lime as possible, since hard water may easily cause precipitates in the dye-liquor which may render the dyed goods uneven.

Although it is possible to work with calcareous water, if a little soda be added, it must be stated that the results are never so certain as in working with soft water.

The supply of soft water depends so much on local conditions that no general rules can be given as to how it can be obtained. It may however be remarked that in the majority of works a good supply for the rather small quantity required for dyeing machines could be procured by collecting all the condensed water. Where sufficient condensed or other soft water is not available, a small water-purifier, such as is built by various engineering works, should be erected.

Dyeing with Diamine Colours.

It is almost impossible to give one general rule for dyeing Diamine Colours in all kinds of dyeing machines, as the construction of the various systems differs too much and the additions depend chiefly upon the quantity of dye-liquor.

The following rules may be considered as a general guide:

1. The cotton is to be packed as tightly as possible so that no channels are formed during the dyeing.
2. In rare cases only it is necessary to wet or boil the cotton previous to dyeing with Diamine Colours, but it is of advantage to begin the dyeing in the boiling or at least warm bath.
3. The additions of salts must not be excessive.
4. A small addition of Turkey-red oil, which however is required in exceptional cases only, facilitates level dyeing and penetration.

Machine-dyeing requires the use of the most easily soluble and best levelling colouring matters. In the following list of Diamine Colours suitable for machine-dyeing, those satisfactory in all cases are marked I, whereas those which are marked II do not dye perfectly level but are still quite serviceable for many kinds of machines.

Yellow.

I Thioflavine S
I Oxy Diamine Yellow GG
I Diamine Fast Yellow A
I Diamine Fast Yellow B
I Diamine Fast Yellow FF
I Diamine Yellow CP

II Diamine Gold
II Diamine Fast Yellow AR.

Red.

I Diamine Rose, all marks
I Diamine Red 4B
I Diamine Red 10B
I Diamine Brilliant Scarlet S
I Primuline, diazotised and developed

II Diamine Scarlet B
II Diamine Scarlet 3B (with soda)
II Diamine Red 5B
II Diamine Red 6B
II Diamine Fast Red F (with soda)
II Diamine Red D.

Orange.

I Diamine Orange G
I Diamine Orange D
I Oxy Diamine Orange G

II Diamine Orange B
II Oxy Diamine Orange R.

Brown.

I Oxy Diamine Brown G
I Diamine Brown S
I Diamine Brown R
I Diamine Catechine B
I Diamine Catechine 3G
I Diamine Nitrazol Brown BD
I Diamine Nitrazol Brown G
I Diamine Nitrazol Brown B
I Diamine Nitrazol Brown T
I Diamine Cutch (with soda)

II Diamine Brown M
II Cotton Brown A
II Cotton Brown N
II Diamine Brown 3G
II Diamineral Brown G
II Diamine Nitrazol Brown GD.

Claret and Violet.

I Diamine Bordeaux B
I Diamine Heliotrope G
I Diamine Heliotrope B
I Diamine Heliotrope O
II Diamine Violet Red (with soda)
II Oxy Diamine Violet G
II Oxy Diamine Violet R
II Oxy Diamine Violet B.

Blue.

I Diamine Blue RW
I Diamine Blue 2B
I Diamine Blue 3B
I Diamine Sky Blue
I Diamine Sky Blue FF
I Diamine Blue C4B
I Oxy Diamine Blue 3R
I Diamineral Blue R
I Diamine Deep Blue R
I Diamine Blue NC
I Diamine Fast Blue C
I Diamine Fast Blue CG

I Diaminogene Blue BB
I Diaminogene Blue G
I Diamine Azo Blue R
I Diamine Azo Blue 2R

II Diamine Blue 3R
II Diamine Blue BX
II Diamine Blue BG
II Oxy Diamine Blue R
II Oxy Diamine Blue G
II Diamine New Blue R
II Diamine Steel Blue L.

Green.

II Diamine Green G
II Diamine Green B
II Diamine Dark Green N.

Black.

I Diamine Black BH
I Diamine Dark Blue B
I Diamine Jet Black RB
I Diamine Jet Black Cr
I Oxy Diamine Black BG
I Oxy Diamine Black W
I Oxy Diamine Black A
I Oxy Diamine Black SA
I Oxy Diamine Black D
I Oxy Diamine Black AM
I Oxy Diamine Black AT
I Oxy Diamine Black AFF
I Oxy Diamine Black FFC
I Oxy Diamine Black RR
I Oxy Diamine Black JEI
I Oxy Diamine Black JB
I Oxy Diamine Black JW
I Diamineral Black B

I Diamineral Black 3B
I Diamineral Black 6B
I Diamine Nitrazol Black B
I Diamine Azo Black B
I Diamine Beta Black B
I Diamine Béta Black BB
I Diaminogene B
I Diaminogene BW
I Diaminogene CCL
I Diaminogene extra

II Diamine Black HW
II Oxy Diamine Black SOOO
II Oxy Diamine Black BZ
II Oxy Diamine Black B
II Oxy Diamine Black BM
II Oxy Diamine Black NF
II Oxy Diamine Black NR.

Direct Dyeings.

Pale shades are usually dyed with:

½ % soda ash
3 % common salt

and dark shades with

½ % soda ash
15 % calc. Glauber's salt.

The dyestuffs of the preceding list bearing the remark "with soda", require an extra addition of 1 % soda ash.

Diamine Red 4B is dyed with ½ % soda ash and 2 % soap in place of soda and salt.

The dyeing is usually carried out in a boiling bath, first the soda and then the previously dissolved colouring matter being added to the bath, and after boiling up, the goods are dyed for about ¾ to 1 hour. The salt may be added either at the beginning of, or during the dyeing operation.

With regard to the additions to the standing bath the directions given in the introduction on page 8 hold good also here and care must be taken that the quantity of salt in the bath does not increase too much. The best means for controlling the additions is to test the liquor from time to time with the hydrometer as indicated on page 9. The specific gravity of the liquor should not exceed 3—4° Tw. for pale shades or 6° Tw. for dark shades. When this concentration is attained the addition of salt should be temporarily suspended.

In some cases Turkey-red oil is added to the bath in order to wet the cotton more effectively, ½—1 % of Turkey-red oil being used and added together with the soda.

Dyeings aftertreated with Metallic Salts.

The dyestuffs suitable for this method of aftertreatment have been described on pages 68 and 206—208 respectively.

After dyeing, the cotton is lightly rinsed and then aftertreated at the boil for about 20 or 30 minutes with the metallic salts enumerated on page 66.

The cotton is then rinsed, if necessary soaped, and dried.

Diazotised and Developed Dyeings.

The dyestuffs suitable for diazotising and developing have been described on pages 85 and 206—208 respectively.

The diazotising and developing is carried out exactly according to the directions given on pages 86, the quantities of nitrite and hydrochloric acid may however be considerably reduced.

For medium shades, 1 % nitrite and
3 % hydrochloric acid,
for dark shades, 1 1/2 % nitrite and
5 % hydrochloric acid

of the weight of the dyed cotton will be found sufficient.

First the nitrite and only a small portion of the requisite quantity of hydrochloric acid is added to the bath, and after this has been allowed to act for about 5 minutes, the rest of the hydrochloric acid is added in several portions, the diazotising process requiring in all about 15 minutes.

The diazotising bath is then run off and the material rapidly rinsed with cold water in the machine itself.

The developing liquors are prepared as described on page 89 and after the rinsing are allowed to act for about 20 minutes. The cotton is then rinsed and if necessary soaped.

Coupled Dyeings produced with Diamine Colours.

The dyestuffs suitable for the coupling process have been described on pages 111 and 206—208 respectively.

The coupling is carried out with Nitrazol or with diazotised Paranitraniline; the quantities are given on pages 112 and 113.

The cotton after dyeing is rinsed with cold water and then treated for about $^1/_4$ — $^1/_2$ hour with the cold coupling liquor which is prepared as described on page 113, without any soda or acetate of soda. It is then rinsed again and if necessary soaped.

In order to shade black dyeings, some New Methylene Blue (0,2—0,3 %) may be added to the coupling bath.

Dyeing with Immedial Colours.

The Immedial Colours, owing to their eminent fastness and simple method of dyeing, have been adopted very generally and with excellent success for dyeing loose cotton, sliver and roving in dyeing machines.

All sorts of dyeing machines may be used, provided they do not contain any parts made of copper or brass. The machines constructed of iron*) or nickel and the nickel-plated iron machines have proved the best.

The circulation of the liquor may be effected either by means of pumps or by steam pressure. Air pressure cannot be used for introducing the liquor, whilst air suction may be employed for drawing off the liquor.

Great care should be taken that the water be free from lime, this condition being essential for machine-dyeing generally, whatever colouring matter may be used (see our remarks on page 204).

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*) Iron machines should, when working is stopped, be rinsed with a solution of soda in order to prevent rusting; this is specially important when they are not in use for a couple of days.

It is also important that the machines are supplied with good arrangements either for suction or for pressing off and rinsing, by which the liquor can be thoroughly drawn or pressed off after dyeing and the goods quickly and thoroughly rinsed.

The dyeing of Immedial Blue C and CR is carried out with this modification that, after dyeing the cotton, the liquor is only sucked or pressed off, but the rinsing is omitted.

Dyeing of Immedial Black in Dyeing Machines.

The first bath is prepared with:

8	oz.	soda ash	per 10 gallons of liquor.
18—20	,,	cryst. sodium sulphide	
2	lbs	cryst. Glauber's salt	
2—2,4	,,	Immedial Black	

For subsequent lots are used:

2 %	soda ash	of the weight of the cotton to be dyed.
9—10 %	cryst. sodium sulphide	
12—13 %	Immedial Black	
5—10 %	cryst. Glauber's salt	

The dye-bath is first charged with soda, then with the dyestuff previously dissolved with sodium sulphide, and finally with Glauber's salt.

The dye-bath having been boiled up with all the additions, the cotton is entered and dyed either at the simmer for one hour or at full boil for about 1/4 hour, in which latter case the steam is shut off after that time and the hot liquor allowed to circulate.

To avoid the periodical spouting of the liquor, it is advantageous to work with rather larger quantities of liquor than usual; this precaution ensures of the material being kept constantly covered by the dye-liquor which is a necessary condition.

At the conclusion of the dyeing process, the liquor is run off, and the liquid remaining in the material is rapidly drawn or pressed off. The cotton is then at once rinsed with cold water or lifted and placed into a second machine filled with cold water. In either case the goods are finally rinsed with lukewarm or hot water.

The dye-liquor and also the first rinsing water may be used over again, the latter serving for replenishing the dye-liquor.

The duration of the dyeing process in dyeing machines may, if necessary, be materially reduced, if the strength of the dye-liquor be increased accordingly.

The temperature may also be varied; sliver is quite frequently entered at 175° F and left for 30 or 40 minutes in the bath, the temperature of which need not be raised.

Regarding the aftertreatment with chromium salts see instructions on page 195.

When there is no aftertreatment, the goods must be very thoroughly rinsed after dyeing.

All dyeings, whether aftertreated or not, should be treated with an addition to the last rinsing bath of 3—5 oz. acetate of soda per 10 gallons of water; having remained a short period in this bath they are dried without any further rinsing.

This aftertreatment with acetate of soda should never be omitted, unless the cotton is to be soaped or otherwise softened after dyeing.

Dyeing of Immedial Direct Blue in Dyeing Machines.

The special brand Immedial Direct Blue B extra conc., being about double the strength of Immedial Direct Blue B, has proved to be the best suited for machine-dyeing.

The first bath is prepared approximately with:

5	oz.	soda ash
10—20	,,	cryst. sodium sulphide
10—16	,,	cryst. Glauber's salt

and with:

3—6 % Immedial Direct Blue B extra conc. { of the weight of the cotton.

For subsequent lots, the additions, according to the shade to be dyed, are:

1 %	soda ash
4—10 %	cryst. sodium sulphide
2— 5 %	Immedial Direct Blue B extra conc.
2— 5 %	cryst. Glauber's salt

calculated on the weight of the cotton.

The boiling liquor is first charged with soda and the colouring matter previously dissolved together with the sodium sulphide, and the dyeing is begun at boiling point; after 15 minutes' working, Glauber's salt is added and the dyeing finished within about 3/4 hour in all. The dye-bath is then run off, the remaining liquor pressed off by steam or drawn off by vacuum and the material immediately well rinsed in the machine.

The procedure for dyeing subsequent lots is similar.

The goods are finally soaped hot according to requirements (3—5 oz. of soap, 1 1/2—3 oz. of soda per 10 gallons) and topped in this soap liquor with basic dyestuffs, if so desired.

Dyeing of Immedial Blue C and CR in Dyeing Machines.

Immedial Blue may in the same way as Immedial Black be dyed in dyeing machines of any kind. The steaming may either take place in the machine itself, or the cotton, after the dyeing and sucking off, is taken out and steamed as described on page 129.

The operation of steaming is in both cases most simple and has been found very satisfactory both for loose cotton and for sliver.

First bath:

8—13 oz. cryst. sodium sulphide 3— 5 „ caustic soda lye 75° Tw. 6— 8 „ cryst. Glauber's salt	per 10 gallons of liquor

15—20 % Immedial Blue;

the first bath must, however, contain not less than 20—24 oz. of colouring matter per 10 gallons of liquor.

For subsequent lots the standing bath is re-charged with

7—12 % cryst. sodium sulphide 1— $1\frac{1}{2}$ % caustic soda lye 75 Tw. 7—12 % Immedial Blue according to the depth of shade	of the weight of the cotton to be dyed.

The bath is boiled up and the cotton entered and dyed for $\frac{3}{4}$ hour near boiling point.

On completing the dyeing operation, the dye-bath is run off to be kept for further use, the remaining liquor is well removed by suction or steam blowing, and the cotton is then steamed.

The cotton may be steamed in the dyeing machine proper as soon as the liquor has been removed. If a separate steam-chest be used, the cotton is well pressed off in the machine, taken out, hydro-extracted and then steamed.

Should the construction of the machine be disadvantageous to the complete removal of the remaining dye-liquor, the goods should be rinsed after dyeing with a solution containing per 10 gallons:

3 oz. sodium sulphide
3 „ caustic soda lye 75° Tw.

This liquor must not be heated, and a few minutes' treatment is sufficient. Having run off this solution, the remaining liquor is pressed off as well as possible and the cotton steamed either in the same dyeing machine or lifted, hydro-extracted, and steamed in the steam-chest.

The steaming is carried out either in the dyeing machine or in a steam-chest with the simultaneous admission of air, as described in detail on page 130.

The steaming lasts about ½ hour.

The steam-pipe and the injector can be easily attached to any kind of dyeing machine, but the conduit should be so arranged that the steam enters as direct as possible into the central cavity of the dye chamber to effect an easy penetration of the dyed and partly desiccated goods.

The steaming is followed by a good rinsing with warm water or by soaping.

Dyeing of Immedial Brown and Immedial Bronze in Dyeing Machines.

The various brands of Immedial Brown and also Immedial Bronze find extensive employment for dyeing loose cotton, sliver and roving.

First bath:

5 —8 oz. soda ash
6½—9½ „ cryst. sodium sulphide } per 10 gallons of dye-liquor.
1 —2 lbs. cryst. Glauber's salt
10 —20 % colouring matter.

For dyeing subsequent lots:

2— 3 % soda ash
3— 5 % cryst. sodium sulphide
5—10 % cryst. Glauber's salt
6—15 % colouring matter.

The method of dyeing is exactly the same as described for Immedial Black.

An aftertreatment with metallic salts is not often applied; coupling with Nitrazol C, however, yields very fine yellowish brown shades. The exact method of coupling has been described on page 210.

Dyeing with Basic Dyestuffs.

In machine-dyeing the basic dyestuffs are used chiefly for topping and in but rare cases on a mordant of tannin and antimony for dyeing very brilliant shades.

The dyestuffs principally used are:

Indazine
Naphtindone
New Methylene Blue
Methyl Violet
Solid Green and Brilliant Green
Safranine
Paraphosphine
Thioflavine T.

The mordanting and dyeing are carried out on the lines indicated on page 145.

The mordanting with tannin is done in a hot bath containing 3—4 % tannic acid. After cooling off, the tannin is fixed in the cold with 1—2 % tartar emetic, and the cotton is then rinsed.

For dyeing, condensed water should if possible be used. The dye-bath is first charged with 3—4 % acetic acid or an equal amount of alumina sulphate and only a small part of the colour solution, the remainder of which is gradually added during the dyeing operation.

The dyeing takes place in a lukewarm bath, which is finally boiled up for a few minutes, but not until it is nearly exhausted. After the dyeing is completed, the goods are well rinsed and soaped, if required.

Topping with Basic Dyestuffs.

The cotton which has been dyed with Diamine or Immedial Colours is rinsed and then topped in a cold bath with the afore named basic dyestuffs, with the addition of 3 % acetic acid (or alum) calculated on the weight of the cotton.

If Naphtindone is used, the acetic acid has to be replaced by 3 % alumina sulphate. Further particulars will be found on page 173.

Full directions for dyeing the more important shades on loose cotton, sliver and roving are given in the succeeding part together with the respective directions for yarn dyeing.

II.

A. Hank Dyeing in the Bark.

C. Dyeing Cotton Hanks, Cheeses and Cops in Dyeing Machines.

C. Dyeing Mercerised Cotton Yarn.

D. Dyeing Hosiery Goods.

Hank Dyeing in the Bark.

Dyeing with Diamine Colours.

Dyeing with Immedial Colours.

- Immedial Black.
- Immedial Direct Blue.
- Immedial Sky Blue.
- Immedial Blue.
- Immedial Blue and Immedial Direct Blue topped with Indigo or with Basic Dyestuffs.
- Immedial Brown and Immedial Bronze.
- Grey and Mode Shades with Immedial Colours.

Dyeing with Basic Dyestuffs.

Dyeing Paranitraniline Red with Paranitraniline and Nitrazol.

Dyeing Cotton Hanks, Cheeses and Cops in Dyeing Machines

(with some examples).

The Dyeing of Cotton Hanks.

- Oxy Diamine Black as One-dip Black on Yarn.
- Diaminogene Black on Cotton Thread.
- Immedial Black on Yarn.

The Dyeing of Cheeses.

- Immedial Blue on Cheeses.
- Naphtindone B B on Cheeses.
- Dyeing of Cheeses in the Foam.

The Dyeing of Cops.

Immedial Black on Cops.
Immedial Blue on Cops.

The Dyeing of Mercerised Cotton Yarn.

Diamine Colours.
Immedial Colours.
Basic Dyestuffs.
Dyestuffs especially suitable for dyeing mercerised yarns.
Colours resisting the subsequent mercerising.

The Dyeing of Hosiery.

Directions for dyeing the more important shades of loose Cotton, Sliver, Yarn and Hosiery.

Dyeing with Diamine Colours.

Before dyeing, the yarn must as a rule be boiled and also bleached if intended for pale shades.

The boiling of the yarn has been rendered unnecessary by a recent innovation consisting in a simple wetting out of the yarn at a temperature of 105—140° F. in a bath prepared with 2—3% Turkey-red oil of the weight of the cotton.

The cotton is worked in this hot bath until wet through and is entered straight into the dye-bath.

This process of wetting is not sufficient if the cotton is to be bleached, it must in this case be boiled off well.

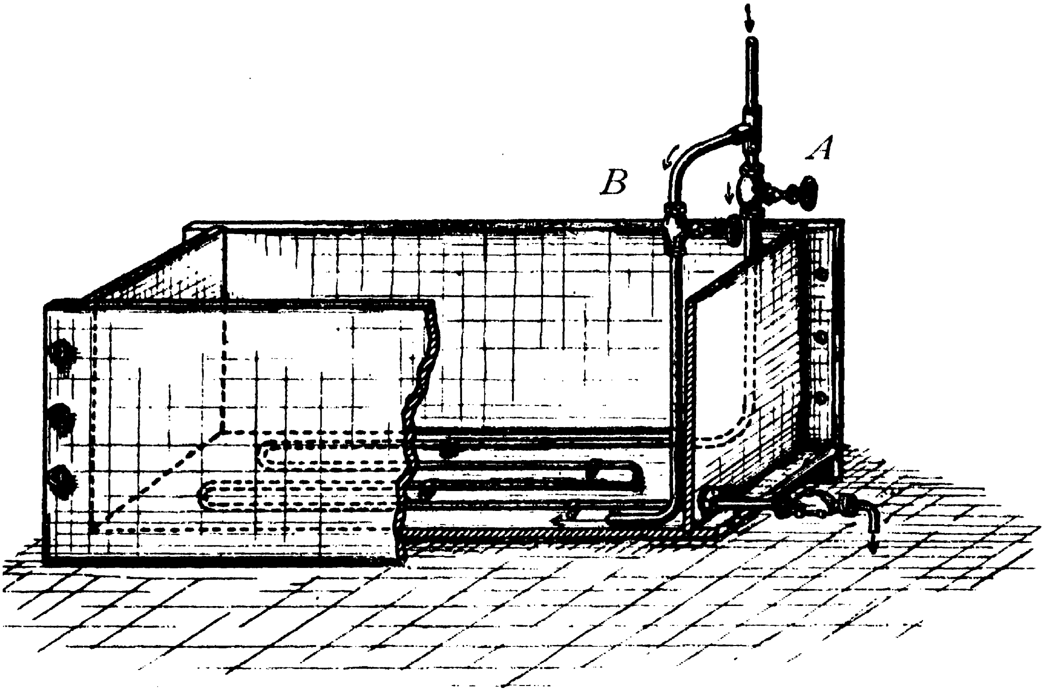
It should be observed that it is not advantageous for the cotton to remain for a prolonged period in the wet state after the boiling and before the dyeing, since uneven colours, especially in pale shades, are very easily caused thereby.

It is therefore advisable never to boil or wet more yarn than can be dyed the same or the following day.

The Diamine Colours are applied in ordinary dye-vats and recently also very frequently in dyeing machines.

When dyeing in open barks, the liquor should be heated by closed steam-pipes, as open steam increases its volume too much, which should if anything diminish towards the end of the dyeing operation.

In order to accelerate the heating of the dye-liquor in boiling with steam-coils, a double set of steam-pipes may be arranged as shown in the sketch below.



A: closed, *B*: open steam-pipe.

During the dyeing proper, the closed steam-pipe *A* is used alone, whilst the open steam-pipe *B* serves chiefly for bringing the bath quickly to the boil before the dyeing begins.

Particulars regarding the preparation of the first bath, the additions to be made to the standing bath, in dyeing with Diamine Colours, and also regarding shading and all the other operations, such as

aftertreatment with metallic salts
diazotising and developing
coupling

are to be found in the general part, the directions for which are primarily given for hank dyeing.

These remarks apply equally to the topping with basic dyestuffs, the combination of Diamine Colours with aniline black, logwood, cutch etc., which are described in detail in the general part.

Dyeing with Immedial Colours.

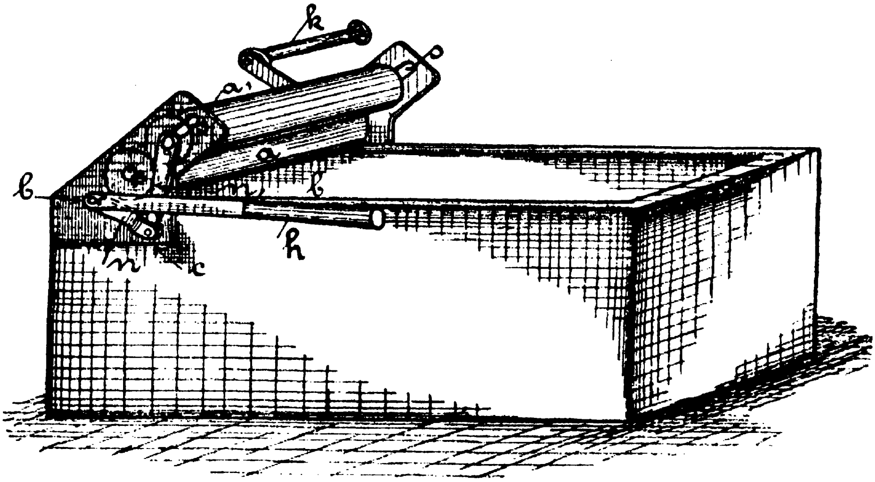
The dyeing of cotton yarn in the hank with the Immedial Colours is quite as simple a process as with the Diamine Colours; the barks, however, should be slightly altered for dyeing with these dyestuffs.

It is of primary importance that those parts of the steam-pipes which may come into contact with the dye-liquor are not made of copper. Iron or lead pipes are the most suitable.

Any other fittings of copper or brass (e. g. waste taps or valves) must either be replaced by such made of iron or lead or be removed entirely.

For the production of level dyes it is also very important that the hanks are well squeezed as soon as they are lifted and immediately rinsed thoroughly in water. The squeezing rollers may be fixed in any desired manner to the narrow end of the vat; to serve their purpose well, they must squeeze the yarn very severely and evenly.

The following sketches show two special methods of arranging the squeezing rollers which have proved very effective:



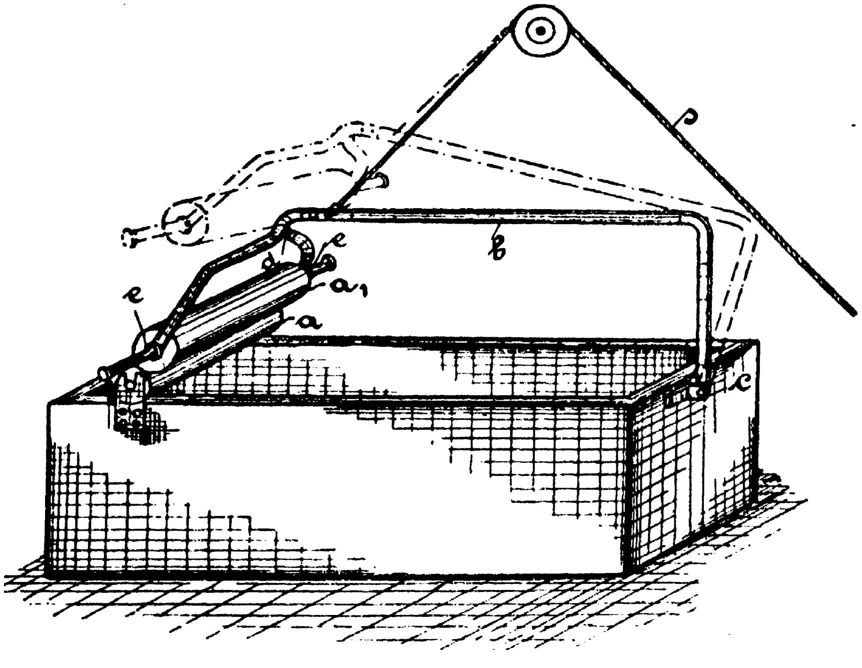
An iron cheek with bearings for the rollers *a* and a_1 is fixed on each long side at one end of the bark, the bearings of the top roller being so adjusted as to move in slots (*s*) when the roller is lifted or lowered, The top roller is raised and lowered by means of the arm of a lever *h* in connection with a knee-joint lever *n* and n_1.

The levers *h* and *n* are firmly joined at *b*, whilst there is a moveable joint at *c* for the levers *n* and n_1. A similar arrangement, but without the lever arm, is fitted to the other side. Both sides are connected by a shaft, passing through *b* right across the bark, by which the lifting and the lowering of the top roller proceeds simultaneously from both sides. The bottom lever is provided with a crank *k*.

The method of working is as follows:

After completing the dyeing proper, the top roller *a* is lifted by raising the lever *h*, the stick carrying the yarn is passed between the two rollers and the yarn laid upon the bottom roller. While one man is pressing down the lever *h*, another turns the crank *k* and the yarn thus passes between the rollers and is freed from the bulk of the adhering liquor.

Another way of arranging the squeezing rollers is illustrated in the sketch below.



One of the narrow ends of the box is provided with a roller *a*, the opposite end carries an iron arm jointed at *c* which reaches the length of the bark and is forked at *d*. The lower ends *e* of the fork carry the bearings for a second roller a_1. Arm and roller a_1 can be raised together by means of the rope *s*.

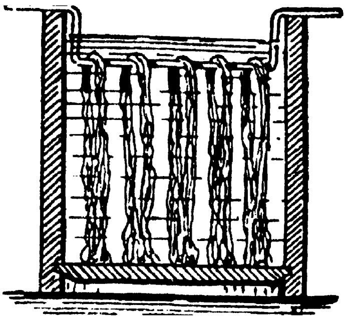
The dyeing proper being completed, the arm is lowered until the roller a_1 rests upon the lower roller *a*, and the yarn is passed through stick by stick, a raising of the top roller being thereby unnecessary.

If high demands with regard to levelness of the colours be made, the use of bent iron pipes is recommended.

For the required purpose, gas pipes of $^3/_4$—1 inch diameter are bent to this shape ¯¯|⎽⎽⎽⎽|¯¯, fitted exactly to the inner width of the vessel, and wrapped with strips of cotton cloth round the parts on which the yarn rests.

Instead of wrapping the rods with cloth, they may, in order to prevent them from rusting, be rubbed every night with a rag dipped into mineral oil, or washed each time after use in water containing some soda and dried at once; the rods are best stored in a drying room or any other warm place.

The method of working with these rods is illustrated by the following sketch.



In most cases straight sticks may be used; before being taken out, the yarn must be turned quickly two or three times, stick by stick, and then well squeezed. The usual lifting and draining off of the hanks must in this case be studiously avoided.

Dyeing with Immedial Black.

First bath

for 100 lbs of yarn in about 200 gallons of water.

10	lbs	soda ash
16—20	„	cryst. sodium sulphide
18—24	„	Immedial Black*)
70	„	common salt.**)

For subsequent lots in the standing bath***) the following quantities, calculated on the weight of the cotton, are used:

2 %	soda ash
16—20 %	cryst. sodium sulphide
20—24 %	Immedial Black*)
6 %	common salt.**)

The bath is charged with all the ingredients and brought to the boil; steam is then shut off and the previously well boiled yarn entered, turned four times in succession by means of a pointed broaching stick, and later on about once every 10 minutes. When working on straight sticks, the hanks are frequently immersed into the liquor after each turning.

The dyeing process lasts about 1—1 ½ hour.

The lifting of the yarn is done stick by stick after it has been turned again once or twice; it is then well squeezed by means of the rollers at the end of the bark. The rinsing which now follows must be done rapidly in a tank placed close by.

Aftertreatment.

The aftertreatment with chromium salts is chiefly applied to the brands V extra, FF extra and G extra, whilst with the other brands it is usually omitted. This aftertreatment, however, renders also the shades of these brands brighter and more bluish and may be recommended in many cases by reason of its simplicity.

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*) The differences between the various brands of Immedial Black to be chosen according to requirements may be seen from the tables on pages 136—139.

**) See note on page 193.

***) The bath may be controlled from time to time by means of the hydrometer as to its strength for salt; it should indicate no more than 8½—10° Tw. or the addition of salt may be temporarily omitted. See page 125.

The quantities for blue black are

3 % bichrome
3 % acetic acid

for jet black

1 1/2 % chrome-alum
1 1/2 % bichrome
3 % acetic acid;

the cotton is worked in the hot bath for 25—30 minutes and then rinsed.

The bath for aftertreatment should be perfectly clear; any precipitate may be easly re-dissolved by a further addition of some acetic acid.

The yarns, whether dyed direct or aftertreated, should always be finally well washed. Unless they are brightened in some other way, they should be passed as a last rinsing through a bath containing 3—5 oz. acetate of soda per 10 gallons of water and dried at once without being rinsed again.

Brightening.

To increase the beauty of the shade, the yarns are often finally brightened, most frequently according to the following method:

The yarns are treated for about 20 minutes in a boiling hot bath prepared with

1—3 % potato or wheat starch } boiled together
1—3 % suet or cocoa-nut oil }

and 3—5 oz. acetate of soda per 10 gallons of liquor, and then dried without rinsing.

If a specially soft handle is to be imparted to the yarn, about 1/2 % oil may be added to the above liquid, or the brightening may be done by treating the yarn for 20 minutes at 160—175° F. in a bath previously softened with a little soda and charged with

3—5	oz.	acetate of soda	per 10 gallons of liquor.
3—5	,,	soap	
$^3/_4$	,,	oil	

From this bath the yarn should be dried without rinsing.

Dyeing with Immedial Direct Blue.

The dyeing is carried out in the above described wooden barks which are supplied at one end with squeezing rollers. The yarn is suspended on straight sticks and worked for $^3/_4$ or 1 hour in the boiling bath, containing about 20 times as much water as the weight of the yarn to be dyed.

The first bath is charged, according to the shade to be dyed, with:

2 %	soda ash
6—14 %	Immedial Direct Blue B
8—16 %	cryst. sodium sulphide
2 %	Turkey-red oil
6—14 %	common salt.

Being charged with all the ingredients, the bath is brought to the boil, steam shut off, and the previously well boiled yarn entered and turned with a pointed broaching stick about once every five minutes. Before lifting, the yarn is rapidly turned stick by stick 2 or 3 times, well squeezed between the squeezing rollers and at once washed several times in water ready at hand. The yarn must not be thrown into a heap or allowed to lie before being washed.

For dyeing subsequent lots in the standing bath, the following additions are made, according to the shade to be dyed:

$^1/_2$ %	soda ash
5—10 %	Immedial Direct Blue B
5—10 %	cryst. sodium sulphide
$^1/_2$ %	Turkey-red oil
3— 6 %	common salt.

An aftertreatment is not necessary to enhance the fastness of Immedial Direct Blue, hot soaping of the thoroughly washed yarn with an addition of some soda (about 3 % soda and 3 % soap) being sufficient, which also increases the brightness of the shade. An aftertreatment with chrome and copper (1 1/2 % bichrome, 1 1/2 % sulphate of copper, 3 % acetic acid) in a hot bath also enhances the brightness of the shade and may therefore be employed whenever soaping is not desired.

To increase the beauty of the dyeings and to obtain certain shades, topping with basic dyestuffs such as Naphtindone, Indazine, New Methylene Blue etc. is recommended.

Dyeing with Immedial Sky Blue.

Immedial Sky Blue is best dyed on bent iron rods, but it may also be dyed without risk on straight sticks, if the requirements as to levelness are not exacting.

The temperature of the dye-bath should not exceed 85 or 95 ° F. In a hot dye-liquor the shade turns out less brilliant.

Charge of the first bath (20 times as much water as the weight of the cotton):

	for pale,	for medium,	for heavy shades:
Immedial Sky Blue	1—10 %	10—20 %	20—30 %
cryst. sodium sulphide	1— 5 %	5—10 %	10—15 %
soda ash	5 %	5 %	5 %
Turkey-red oil	2 %	2 %	2 %
common salt	2—20 %	20—40 %	40—60 %

The dye-bath exhausts but imperfectly, about one half of the colouring matter remaining in the bath. Hence, for dyeing subsequent lots in the standing bath, the following quantities, which may be considered as those actually consumed, are added.

Additions for dyeing in the standing bath:

	for pale,	for medium,	for heavy shades:
Immedial Sky Blue	$^1/_2$—5 %	5 — 9 %	9—13 %
cryst. sodium sulphide	$^1/_2$—2 $^1/_2$ %	2 $^1/_2$— 5 %	5— 7 $^1/_2$ %
soda ash	1 $^1/_2$ %	1 $^1/_2$ %	1 $^1/_2$ %
Turkey-red oil	$^1/_2$ %	$^1/_2$ %	$^1/_2$ %
common salt	$^1/_2$—5 %	5—10 %	10—20 %

Only one half of the indicated quantity of soda is added to the dye-liquor (the other half being used for dissolving the dyestuff), then the hot colour solution and finally Turkey-red oil and salt are added.

The well boiled yarn is entered at 85—95° F. into the ready dye-bath, and is worked from time to time, without any further heating, in all about $^1/_2$ hour. It is then squeezed, stick by stick, and wrung off rapidly and as evenly as possible, first three times easily and then 2 or 3 times severely; after this it is aged for 15 to 30 minutes and finally rinsed, first in cold water and then once in warm water. To prevent the yarns from becoming partially dry, they should not be allowed to hang for more than $^1/_2$ hour.

Aftertreatment.

To satisfy exacting demands regarding fastness to light and washing, the dyed yarns may be aftertreated at 175° F. with

1 % bichrome 1 % sulphate of copper 3 % acetic acid	for pale shades	1 $^1/_2$ % bichrome 1 $^1/_2$ % sulphate of copper 3 % acetic acid	for medium and heavy shades.

Care must be taken, especially with calcareous water, that sufficient acetic acid be used.

The yarn is worked for about 20 minutes and rinsed.

The shade is but slightly altered by this aftertreatment.

Dyeing with Immedial Blue C and C R.

Immedial Blue is dyed like Immedial Black in barks provided with squeezing rollers. It is immaterial whether bent rods or straight sticks are used; levelness is however best obtained on bent rods.

First bath

for 100 lbs of yarn in about 200 gallons of water.

1— 2 lbs caustic soda lye 75° Tw.
10—20 „ cryst. sodium sulphide
10—20 „ Immedial Blue (according to the depth of shade)
10—20 „ cryst. Glauber's salt.

For dyeing subsequent lots, the following additions, calculated on the weight of the cotton, are made:

1— 2% caustic soda lye 75° Tw.
4— 9% cryst. sodium sulphide
6—12% Immedial Blue (according to the depth of shade)
2— 3% cryst. Glauber's salt*)

When charged with all the ingredients, the bath is boiled up, steam shut off, the previously well boiled yarn entered and turned 4—6 times in succession by means of a pointed broaching stick, afterwards once every 5 or 10 minutes, and the dyeing is completed in about $^3/_4$—1 hour without re-heating the bath.

The dyeing being finished, the yarn is passed through the squeezing rollers and, without being rinsed, is wrung off and straightened out three times as sharply and rapidly as possible, and then put into the steam-chest.

Steaming of Immedial Blue Dyeings.

The steaming is described on page 129 and best carried out in a dye-bark provided with raised sides and a perforated bottom. The yarns are suspended in this bark in such a way as to be clear of the perforated bottom by at least 4 inches. It is well to heat the steam-chest before charging it with the yarn, which must be protected by a cover of dry cloth against condensed steam causing spots.

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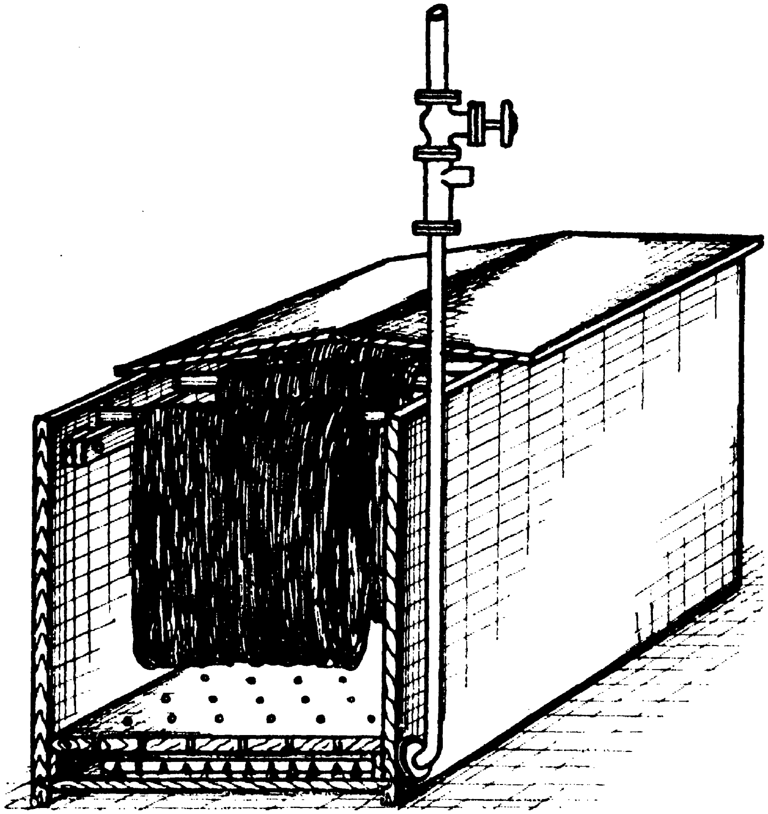
*) To prevent the bath from becoming overcharged with salt in prolonged working in the standing bath, the addition of Glauber's salt is often entirely dispensed with.

The cover of the steam-chest, which is lined with cloth fastened on to a wooden lattice frame, should best have the form of a slightly overlapping roof.

The following sketch shows the arrangement.



The yarns are suspended in the chest on ordinary sticks similarly as for dyeing. The cover having been adjusted, both steam and air are blown in. After steaming for $^1/_2$ or $^3/_4$ hour, the blue will be completely developed. The yarns are then removed and rinsed in warm water and, if so desired, soaped hot or topped.

For matching Immedial Blue dyes, the undeveloped colour is made use of, a small pattern being taken as a guide, rinsed in cold water, passed through dilute acetic acid or a weak solution of alum and kept after drying without rinsing again. By this treatment the shade is permanently fixed, and as steaming, always has exactly the same effect upon the shade of the dyeings, it is sufficient to match the undeveloped dyes.

Immedial Blue and Immedial Direct Blue as Bottoms for Indigo.

Regarding the working of these important combinations see page 179.

Topping Immedial Blue and Immedial Direct Blue with Basic Dyestuffs.

The dyes produced with Immedial Blue and Immedial Direct Blue are frequently topped with basic dyestuffs, the various brands of New Methylene Blue and also Indazine M and Naphtindone BB being particularly suitable for this purpose. The latter produces especially in dark shades the coppery appearance so much liked in Indigo Blues.

The topping is done in a cold bath containing acetic acid or sulphate of alumina, the colour being added in several lots. As soon as the bath is exhausted, heat is applied and the yarn worked for another 10 or 15 minutes. The yarn is then well rinsed and dried.

Dyeing of Immedial Brown and Immedial Bronze.

The dyeing of yarns is carried out similarly as described for Immedial Black, viz. on straight sticks and in barks provided with squeezing rollers.

First bath

for 100 lbs of cotton yarn,
according to the depth of shade:

6—10	lbs	soda ash
6—10	,,	cryst. sodium sulphide
8—16	,,	Immedial Brown
40—80	,,	common salt.*)

For subsequent batches the old bath is replenished with about the following quantities calculated on the weight of the cotton:

2— 3 °/o	soda ash
3— 6 °/o	cryst. sodium sulphide
6—12 °/o	Immedial Brown
5— 8 °/o	common salt.*)

These colours are not as a rule aftertreated.

They become however deeper and faster to light by $^1/_2$ hour's aftertreatment with

1 °/o	sulphate of copper
2 °/o	bichrome
3 °/o	acetic acid,

whilst by coupling with Nitrazol, much richer and yellower shades are produced. The coupling is carried out exactly as described on page 112. The cotton is finally well rinsed.

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*) See note on page 193.

Grey and Mode Shades produced with Immedial Colours.

By dyeing pale shades and also by combining the various Immedial Colours with one another, a large range of very fast grey and mode shades may be obtained which have found great favour in yarn dyeing.

Pale shades may be dyed with the addition of soda and sodium sulphide similarly as with the Diamine Colours, viz. without the use of squeezing rollers, whilst for medium and dark shades it is advisable to work with squeezing rollers.

For the production of grey shades the various brands of Immedial Black are used, especially

Immedial Black NB
,, NG
,, NR
,, NF,

whilst the manifold mode and drab shades are produced with

Immedial Brown G
,, B
Immedial Dark Brown A

either alone or shaded according to requirements with one of the above named Immedial Blacks.

For the purpose of shading these colours, some of the Diamine Colours which can be dyed in the same way as the Immedial Colours may be added along with the latter to the dye-bath (see page 134.)

The colours may, besides, be topped either with basic dyestuffs or Diamine Colours.

The dye-bath is usually charged with about:

3 % soda ash
3—4 % sodium sulphide
3—4 % Immedial Brown either alone or combined with Immedial Black.

Glauber's salt is added for darker shades only.

The goods are dyed for about ½ hour in a warm bath, and rinsed.

The colours are exceedingly fast to washing, acids and light. Combinations containing Immedial Brown acquire increased fastness to light by an aftertreatment with

1 % bichrome
1 % sulphate of copper
2 % acetic acid.

The yarns are treated for about 15 minutes at 140—175° F., and rinsed.

Dyeing with Basic Dyestuffs.

The basic dyestuffs are principally employed for the production of very brilliant shades.

Their application on cotton yarns has been described in the general part (pages 145 — 163); these remarks are therefore confined to a description for dyeing Naphtindone only, as this method varies from the one generally employed.

After the usual boiling and wringing, the hanks are mordanted by steeping them for 12 hours in a decoction of sumac leaves of 175° F. As a small addition of acetic acid very much accelerates the exhaustion of the tannin liquors and also acts very favourably on the levelness of the mordanting, $^3/_4$ pint commercial acetic acid (30 %) for about 100 lbs of yarn is added to the mordanting bath.

The yarn is turned 6 times in quick succession and again twice at short intervals, then submerged on the sticks below the surface of the liquor which must fully cover it.

After 12 hour's mordanting (usually over night), the yarns are wrung and passed into the antimony bath for fixing.

The yarns should be brought into the mordanting liquor the same day they are boiled off, the levelness of the colours depending to a great extent thereon.

The following quantities have been found the most suitable for preparing the mordanting baths:

for dyeings		sumac leaves	double salt of antimony
with 1 %		7 %	$^3/_4$ %
„ $1^1/_2$ %	Naphtindone.	10 %	1 %
„ 2 %		15 %	$1^1/_2$ %
„ $2^1/_2$ %		19 %	2 %

The dyeing must be carried out in a slightly acid bath.

The colouring matter is mixed to a paste with acetic acid (about 1/2—3/4 pint for 1 lb.) and then dissolved by the addition of boiling water. By this mode of proceding, the dyestuff is easily and completely dissolved and, the acetic acid besides causes the dye to strike evenly.

The dye-bath is prepared with 2%—3% sulphate of alumina and the yarn, which has been well rinsed and wrung off after the antimony passage, is turned 6 times in the dye-bath and then lifted. The requisite quantity of colour is now added in 2 or 3 portions, according to the depth of shade, the yarn being turned 5 times after every addition.

When the dyestuff has been almost entirely exhausted, the yarn is lifted, the liquor heated to 120° F., the yarn turned for 20 minutes, lifted again to heat the liquor to 165° F., turned for another 20 minutes, lifted, and, after bringing the bath to the boil, turned for 1/2 hour in the boiling bath.

If the baths are not quite clearly exhausted, a decoction of about 1 or 2 lbs of sumac leaves is added and the yarn worked for 1/2 hour longer, whereby the baths become perfectly exhausted and the fastness of the colours is improved.

Dyeing Paranitraniline Red on Cotton Yarn

with Paranitraniline C or Nitrazol C.

For the production of Paranitraniline Red, either Paranitraniline is used or its staple diazo compound, which is sold under the name of Nitrazol C.

In introducing this process as a new branch of dyeing, it has generally been found of advantage to commence with Nitrazol C and only to use Paranitraniline, if so desired at all, after the necessary practice of working with the diazo solution has been acquired.

With regard to purity of the shades obtained there is no difference between the two products.

Depending on the yellowish or bluish shade of red desired, the yarn is prepared either with Beta-Naphtol alone or with a mixture of 12 parts of Beta-Naphtol and 1 part of Red Developer C. This mixture renders the shade considerably brighter and bluer than Beta-Naphtol by itself.

The proportion of 12 parts of Beta-Naphtol to 1 part of Red Developer C should be carefully maintained to attain the fastest colours, because an increased of Red quantity of Red Developer does not yield any better results.

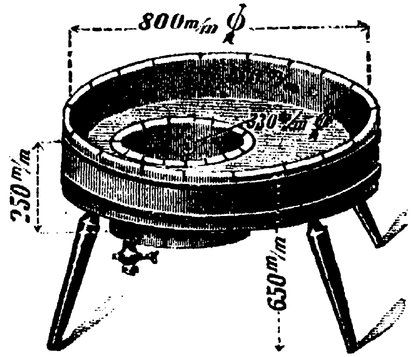
Preparing of the yarns.

The yarns are first boiled with caustic soda or soda ash and then well washed and dried. They should be perfectly dry before they are prepared with Beta-Naphtol.

I. Mordanting with Beta-Naphtol.

The mordanting or preparing with Beta-Naphtol is always done in the same manner, immaterial whether the red is to be developed with Paranitraniline C or Nitrazol C.

The yarn is prepared in a tub of this shape:



The composition of the preparing bath is the following:

For 100 lbs. of yarn:

	A) Preparing liquor with Beta-Naphtol alone	B.) Preparing liquor with Beta-Naphtol and Red Developer C.
I.	2 lbs. $3^1/_4$ oz.	2 lbs. $3^1/_4$ oz. Beta-Naphtol and 3 oz. Red Developer C are mixed with
	2 lbs. $3^1/_4$ oz.	2 lbs. 7 oz. caustic soda lye 77° Tw., to which
	2 gallons $1^1/_2$ pts.	2 gallons $1^1/_2$ pts. boiling water are added.

In another vessel are dissolved:

II. 5 lbs. $8^1/_4$ oz. castor oil soap*) in
2 gallons $1^1/_2$ pts. boiling water.

The solutions I and II are mixed and diluted to 13 gallons $1^1/_2$ pts.

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*) The castor oil soap is prepared as follows:

10 lbs.	castor oil of the first pressing are well mixed with
$8^1/_2$ „	caustic soda lye 36° Tw. and boiled 1 hour; after about 5 hours, when the soap has cooled down somewhat,
2 lbs. $3^1/_4$ oz.	hydrochloric acid 32° Tw. are added; the whole is boiled again for $^1/_2$ hour and after it has become cool the salt solution is drawn off.

It is advisable for small establishments to buy the castor oil soap ready for use, as it is manufactured in good quality by most makers of Turkey-red oil and is hardly more expensive than the product prepared by the dyer himself.

The tub is filled with 2^3/$_4$ gallons of this preparing liquor which should be lukewarm (about 105° F.), and 2 lbs of the yarn are passed through; 1^1/$_2$ pts. more of the mordanting are then added and again 2 lbs of the yarn passed through, and so on until the whole lot of 100 lbs has been thus treated. The same yarn is then passed a second time through the same liquor in batches of 2 lbs, wrung off, wrapped into thin cotton cloth (calico) and well whizzed for 15 or 20 minutes.

After this the yarns are suspended rather loosely on square sticks (not more than 1 lb of yarn per stick) and sharply dried for about 6 hours in a drying room, whis is best done over night.

The drying rooms employed for this purpose may be large wooden chests about 2 yards wide, 3^1/$_2$—4 yards long and 2^1/$_2$—3 yards high and well isolated with infusorial earth, the front of which slides in grooves. Lengthways two poles are fitted inside for supporting the square sticks with the yarn. Iron pipes heated by steam are arranged at the bottom. — This special arrangement is recommended, because the required temperature cannot be obtained in the ordinary drying chambers, and the yarn mordanted with Beta-Naphtol must be dried separately, in order to prevent the yarns from coming into contact with acid vapours such as of acetic acid, whereby the colour would become spotted.

The prepared and well dried yarn should be developed with the least possible delay with diazotised Paranitraniline or with Nitrazol.

Both the hydro-extracted and the dried yarns should be well protected against moisture of any kind and therefore best stored in a wooden box.

II. Developing.

a) Developing with Paranitraniline C.

For 100 lbs. of yarn.

Liquor A.	3 lbs 1 1/3 oz.	Paranitraniline C are well mixed with
	6 1/2 pts.	boiling condensed water and dissolved with
	5 3/4 pts.	hydrochloric acid 32° Tw.
		This acid solution is run in a thin stream with continuous stirring into
	5 gallons	water which should be as cold as possible, whereby the Paranitraniline hydrochloride is separated in the shape of fine crystals.
		After the solution has been cooled off to not less than 57° F.,
	1 lb. 12 oz.	nitrite of soda dissolved in
	4 1/4 pts.	cold water are poured in in one lot and the solution resulting after about 10 minutes is diluted to:
	9 1/4 gallons.	

In another vessel

Liquor B.	1 11/16 pts.	caustic soda lye 77° Tw. or 4 1/4 pts. lye of 36° Tw. are diluted with cold water to
	3 1/6 gallons.	

Or:

Liquor B I.	1 1/2 pts.	caustic soda lye 77° Tw. or 3 3/4 pts. lye of 36° Tw. are diluted with cold water to
	1 gallon 5 1/2 pts.	mixed with a solution of
	4 lbs. 5 oz.	acetate of soda in
	1 gallon 5 1/2 pts.	cold water and the whole is diluted to
	3 1/6 gallons.	

Note:

The liquor B I., on account of the use of acetate of soda, is a little more expensive than the liquor B, but admits of working with greater certainty in regard to levelness of colour.

b) Developing with Nitrazol C pat.

For 100 lbs of yarn.

Liquor A.	15 lbs 7 oz.	Nitrazol C are dissolved whilst stirring in
	$6^{1}/_{2}$ gallons	cold water. The solution, after 30 or 40 minutes' standing, is passed through a hair sieve and diluted to:
	$9^{1}/_{4}$ gallons.	

In another vessel

Liquor B.	$4^{1}/_{4}$ pints	caustic soda lye 77° Tw. or $10^{1}/_{2}$ pts. lye of 36° Tw. are diluted with cold water to
	$3^{1}/_{6}$ gallons.	

Or*)

Liquor B I.	$3^{7}/_{8}$ pts.	caustic soda lye 77° Tw. or $9^{11}/_{16}$ pts. lye of 36° Tw. are diluted with cold water to
	1 gall. $5^{1}/_{2}$ pts.	mixed with a solution of
	4 lbs 5 oz.	acetate of soda in
	1 gallon $5^{1}/_{2}$ pts.	cold water and the whole is diluted to
	$3^{1}/_{6}$ gallons.	

For developing, 7 parts of liquor A and 3 parts of liquor B or B I respectively are used and a somewhat larger tub than that used for mordanting is employed (one measuring about 16 inches in diameter and 10 inches deep, holding about $6^{1}/_{2}$ gallons).

This tub is charged with 2 gallons 5 pts. water, as cold as can be had, 2 gallons $1^{5}/_{8}$ pts. of liquor A and $7^{5}/_{8}$ pts. of liquor B or B I respectively and the mordanted, dried yarn is passed through (2 lbs), wrung off, passed through again (altogether about 1 minute), and finally wrung off. Then $1^{1}/_{8}$ pts. of liquor A and $^{1}/_{2}$ pt. of liquor B or B I. respectively are added and again 2 lbs developed, and so on, until the whole lot of 100 lbs has been developed.

The yarn is now placed on ordinary yarn sticks, rinsed very well and soaped in an ordinary bark; it will be observed that the red becomes considerably bluer by hot soaping.

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*) See note on the preceding page.

Note:

The first lots dyed may sometimes show yellow bars, which are chiefly caused by the wooden sticks used for drying the mordanted yarn not yet being sufficiently impregnated with the Naphtol solution. It is therefore advisable to impregnate fresh sticks before use with some Naphtol solution.

The proportions for preparing the diazo solution of Paranitraniline (liquor A) have been so calculated that no ice is needed for diazotising if very cold well water be used. On very hot days, however, especially if the temperature of the dye-house should be higher than 70° F., it is advisable to throw small pieces of ice into the tub.

Special attention must be paid to the concentration of the hydrochloric acid and the caustic lye, also to the measuring of all chemicals and their solutions. A good result in dyeing can only be assured if the above given proportions as to concentration and weights and the prescribed methods of working are carefully observed.

The Dyeing of Cotton Yarn, Cheeses and Cops in Dyeing Machines.

The directions given on pages 204 to 217 for dyeing loose cotton equally apply for dyeing cotton yarn in hanks, cheeses or cops in dyeing machines; the same colouring matters and the same dyeing methods being as a rule employed.

The Dyeing of Cotton Yarn in Dyeing Machines.

The dyeing of yarns in dyeing machines, in addition to saving labour, offers chiefly the advantage of leaving the yarns in their original condition and of their being less affected than when dyed in the bark. This advantage is specially prominent with fine cotton yarns.

The same dyeing machines are used for cotton yarns as for loose cotton. While charging the machine with yarn, care should be taken that the hanks are placed close enough to each other to avoid the formation of channels during the dyeing process, which may easily cause unevenness.

When dyeing with Diamine Colours it is in most cases unnecessary to previously boil the cotton, and the dry yarn may be brought direct into the dye-liquor.

When dyeing with Immedial Colours, wetting may also be dispensed with, although it is better, especially for dyeing fine counts, to first boil the hanks with soda and add the colouring matter afterwards.

As mentioned above, the general instructions are exactly the same as for dyeing loose cotton. In the following only a few examples from practice are therefore given, which will help to explain the dyeing in machines.

Oxy Diamine Black as One-Dip Black for Yarns.

100 lbs of cotton.

Quantity of water about 60 gallons.

The dye-bath is prepared with:

1 lb soda ash
9 lbs Oxy Diamine Black FFC, previously well dissolved in boiling water,
12 ,, cryst. Glauber's salt.

After boiling up the liquor well, the yarn is dyed one hour at the boil, when the steam is shut off and the dyeing continued for 1/4 hour without steam. The dye-liquor is then pressed off and the yarn rinsed with cold water until the latter runs off perfectly clear.

For dyeing subsequent lots in the old bath, the following additions only are made for

100 lbs of cotton:

5 oz. soda ash
6 lbs Oxy Diamine Black FFC
4 ,, cryst. Glauber's salt.

Diaminogene Black on Cotton Thread.

100 lbs of cotton.

Quantity of water about 60 gallons.

The machine is first charged with:

1 lb soda ash and
1/2 ,, Turkey-red oil,

and the cotton well boiled in this liquor for 1/4 hour. The liquor is then run off and the dye-bath re-charged with:

1/4 lb soda ash
7 lbs Diaminogene B, previously dissolved in condensed water, and
15 ,, desiccated Glauber's salt.

The bath is well boiled up, the yarn dyed for 3/4 hour at the boil and another 1/2 hour without steam. The liquor is then run off and the yarn washed with cold water.

For diazotising are to be used:

1 1/2 lbs nitrite of soda
5 „ hydrochloric acid,

the cold bath first being charged with the nitrite alone and after allowing the latter to act for 5 minutes, the acid is added.

After about 15 minutes' diazotising, the liquor is run off and the cotton taken once through cold water.

The developing bath, which now follows, contains

9 1/2 oz Phenylene Diamine and
2 lbs soda ash

and the developing process takes about 20 minutes. Finally the yarn is well rinsed.

For dyeing subsequent lots in the standing bath, the following additions are made

for 100 lbs of cotton thread:

1 1/2 oz soda ash
5 lbs Diaminogene B
4 „ desiccated Glauber's salt.

The dyeing is carried out as described above.

Immedial Black on Yarn.

Starting bath for 100 lbs of yarn.

Quantity of dye-liquor about 50—60 gallons.

The cotton is first well boiled in the machine for 1/4 hour with:

1 1/2 lb soda ash

and the liquor run off.

The dye-bath is charged with:

3 lbs soda ash
12 „ cryst. sodium sulphide
22 „ Immedial Black NB
18 „ cryst. Glauber's salt.

The bath having been brought to the boil, the cotton is dyed at the simmer for about 1 hour.

The dyeing operation being finished, the dye-liquor is pressed off into the reservoir and the yarn at once rinsed with cold water until the water becomes perfectly clear. (See also page 212.)

Finally the yarn is aftertreated with:

3 lbs acetate of soda,

the liquor run off, and the yarn hydro-extracted without further rinsing.

Continuous dyeing in the old bath is carried out in the same way, the dye-bath being re-charged

for 100 lbs of yarn

with:

1/2	lb	soda ash
9—10	lbs	cryst. sodium sulphide
12—13	„	Immedial Black NB
5	„	cryst. Glauber's salt.

The Dyeing of Cheeses in Dyeing Machines.

The dyeing of cheeses does not offer any more difficulties than the dyeing of loose cotton or yarns in the hank. Like the latter, the cheeses must also be well packed, and the interstices should therefore be filled up completely with either loose cotton or some other suitable material.

The machines which are used for dyeing loose cotton serve also most frequently for dyeing cheeses, and thus the instructions given on page 204 also hold good for this material.

The following directions are only intended as additional examples; the methods of dyeing are always the same, no differences existing in the methods of dyeing loose cotton, yarns in hanks or cheeses.

Immedial Blue on Cheeses.

100 lbs of cheeses in about 100 gallons of liquor.

First bath: 17 lbs Immedial Blue CR
17 „ cryst. sodium sulphide
4 „ caustic soda lye
20 „ cryst. Glauber's salt.

The bath is boiled up and the dry cotton entered and dyed for $^3/_4$ hour.

The dyeing operation being completed, the liquor is pressed off and the material rinsed with some sodium sulphide and caustic soda lye (see details on page 215). The rinsing liquor is then drawn off thoroughly or removed as perfectly as possible by hydro-extraction, and after this the material is steamed for $^1/_2$ hour according to the instructions on pages 129 and 215.

For continued dyeing in the same bath, the following additions are made, according to the depth of shade required:

For 100 lbs of cheeses:

8—12 lbs Immedial Blue CR
8—12 „ cryst. sodium sulphide
1 lb caustic soda lye
4 lbs cryst. Glauber's salt.

Naphtindone BB on Cheeses.

For 100 lbs of cheeses.

Without being previously boiled, the cheeses are mordanted for $^3/_4$ hour with 15—16 lbs of sumac extract in a warm bath, slightly rinsed and aftertreated with $2^3/_4$ lbs of antimony salt; they are then thoroughly rinsed and dyed.

The dye-bath is first charged only with
3 lbs sulphate of alumina
3 „ acetic acid;
the cotton is entered, the liquor heated to 120° F. and allowed to work for 15 minutes.

In the meantime 1 lb 12½ oz Naphtindone BB and 3½ oz New Methylene Blue N have been dissolved with the addition of 1 pint acetic acid in about 22 gallons of condensed water. This solution is gradually added to the dye-bath within about ½ hour, and the bath is then slowly brought to the boil and boiling kept up for ½ hour until the bath is perfectly exhausted.

The dyeing operation being completed, the cotton is well rinsed. ¹)

The Froth Dyeing of Cheeses.

Cheeses are also frequently dyed in the froth. The following is a description of a suitable apparatus which is easily made and can also be applied for cop dyeing, so long as the demands for levelness are not very exacting.

The apparatus consists of a square wooden box, about 5½ to 6 feet high and 3—3½ feet wide, fitted with a steam-pipe of abt. 2 inches diameter and 25—36 feet length in all. The steam-pipe passes down one side of the box to the bottom and there ends in a coil which may be perforated to replace the evaporating liquor by the condensing steam. If the steam, however, be very wet and thus dilute the liquor too much, the steam-pipe must not be perforated and the liquor be brought up to its original volume from time to time.

The second part of the apparatus is a cage made of laths which holds the cheeses, and is lowered into the dye-box by means of a crane. The cage is provided with short wooden legs

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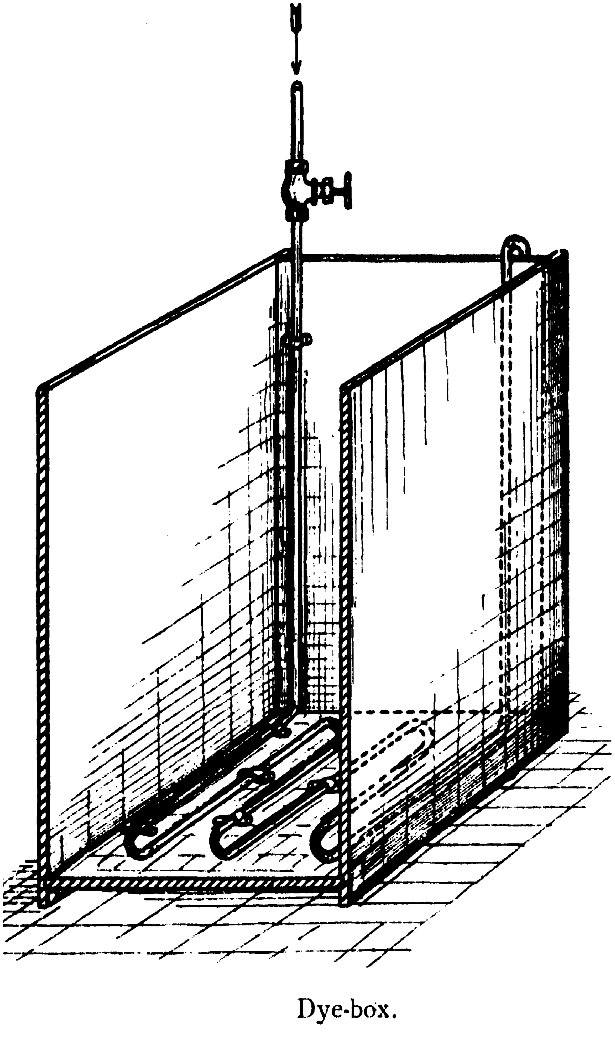
¹) Basic dyestuffs are also dyed in dyeing machines in the following manner: The cotton is mordanted in the machine for about ½ hour at 140° F. with 3—4% tannic acid, the colour added in several portions with the addition of 3% acetic acid, or 3% sulphate of alumina, and the bath heated to 140° F.

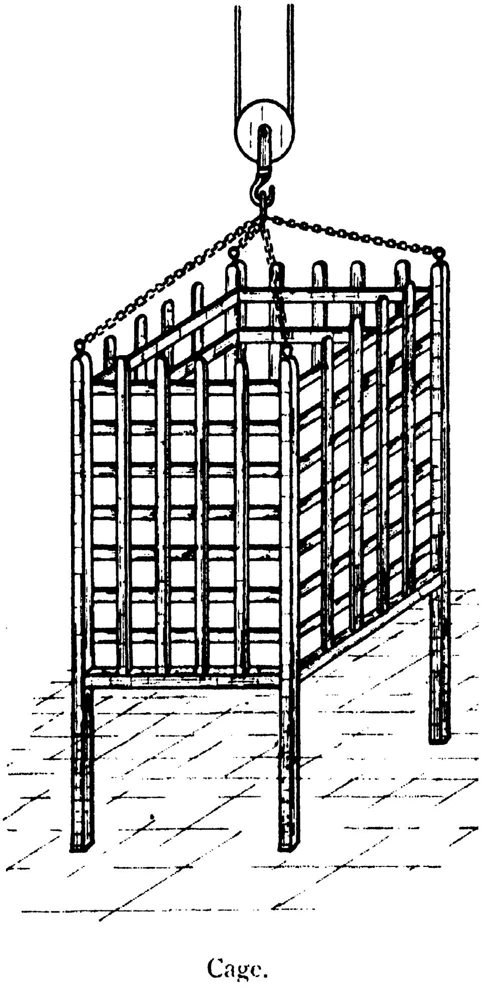
After the dye-bath has been exhausted, the goods are slightly rinsed, and the colour is then fixed in a fresh bath with ½—2% antimony salt. Finally the goods are well rinsed.

to prevent the bottom layer of the cheeses from coming into contact with the boiling dye-liquor during the dyeing operation.

The construction of the apparatus is given in the following sketch; one side of the dye-vessel is left open in order to show the interior of the box.



Dye-box.



Cage.

To dye

200—225 lbs of cheeses

the quantity of water required is 80 or 90 gallons. The dye-liquor, is added, brought to the boil and the cage containing the dry cheeses lowered into the dye-box.

The steam-valve is now opened sufficiently wide to make the froth rise to the top of the box, at which height it should be kept by regulating the steam-valve.

In this apparatus cheeses are principally dyed black, the Oxydiamine Black D, AM and FFC chiefly finding application.

The first bath is prepared with 5 % of colouring matter, whilst for subsequent lots 4 % are sufficient.

For dyeing cheeses black, the dye-bath is charged with the colouring matter only (without any addition of salt). The dyeing operation requires 1 1/2—2 hours.

For dyeing fancy shades, the dyestuffs specially suitable for machine-dyeing generally, as mentioned on page 206, find application. The lighter shades are usually dyed with the addition of 2 % Turkey-red oil.

It should be mentioned that the paper tubes of the cheeses must be filled with scewers of iron or some other metal, wooden sticks twisting too easily in the hot dyeing.

The Diamine Colours are used principally for the production of the various shades. Recently, however, the Immedial Colours have also been employed. They are dyed in the same manner as described for the Diamine Colours, sodium sulphide being added to the dye-bath.

The general process of dyeing Immedial Black is as follows:

For 200 lbs of cheeses:

First bath:
9 % Immedial Black NR
25 % sodium sulphide
5 % soda ash
25 % Glauber's salt.

For subsequent lots:
6 % Immedial Black NR
12 % sodium sulphide
3 % soda ash
15 % Glauber's salt.

After dyeing, the material is at once rinsed in the hydro-extractor by turning cold water on to it until the water runs off clear, the use of a hydro-extractor with an iron or tinned copper drum being recommended.

To the final rinsing bath 5—6$^1/_2$ oz. acetate of soda per 10 gallons of liquor should be added, the material being whizzed in this solution for a few minutes.

The brands principally used are Immedial Black NR, NF and NB, and for brown shades Immedial Brown G.

Only iron steam-pipes must be employed when dyeing with Immedial Colours, and the filling of the paper tubes with iron or other metal skewers must not be overlooked.

The Dyeing of Cops in Dyeing Machines.

The dyeing of cops in dyeing machines is somewhat more difficult than the dyeing of cheeses or yarns in hanks, in so far as sometimes cops become damaged and consequently the result unsatisfactory. This drawback may however be avoided by increased attention, and excellent results are in fact obtained in some machines, not only with Diamine Colours but also with Immedial Colours.

The machines employed for cop dyeing may be divided into two groups, viz., those into which the cops are laid and tightly packed similarly to cheeses, and those in which the cops are fixed on spindles, before dyeing.

If the cops are packed into the machines, care must be taken to fill up the interstices well; this may be done either with loose cotton and subsequent hard pressing, or, in some machines, with granular sand. The method of working in the latter case is as follows:

The machine is first lined with cotton cloth of sufficiently close texture to prevent the sand from passing through, and then the cops, the tubes of which are provided with wooden pegs, are packed in and well covered with a thick layer of well washed sand. The sand fills all the interstices by pouring water over it, and the machine is then closed.

The dyeing is then carried out exactly as described for loose cotton on page 204.

For dyeing cops on spindles, special machines are used, in which the dye-liquor is forced to circulate either by means of a pump or by suction and air pressure. In machines where air pressure is applied, the extraction of the liquor may be effected by vacuum, but in the case of Immedial Colours the forcing through of the liquor by air pressure is excluded, steam pressure always being resorted to.

Spindles of brass or iron may be used for dyeing Diamine Colours, whilst for Immedial Colours nickel-plated spindles have proved best.

Steam coils are best used for heating the dye-liquors, the dye-baths becoming too much diluted by open steam-pipes.

Immedial Black on Cops.

For 100 lbs of cops:

First bath:	180	gallons water
	32	lbs Immedial Black
	16	,, cryst. sodium sulphide
	12	,, soda ash
	16	,, cryst. Glauber's salt.
For subsequent lots:		
	12	lbs Immedial Black
	8	,, cryst. sodium sulphide
	8	,, soda ash
	6	,, cryst. Glauber's salt.

The cops are dyed at the boil from the beginning. It depends on the construction of the machine whether the liquor is drawn and forced by means of a pump, or sucked by vacuum and forced back by steam pressure. The duration of the dyeing process varies from 1/2—1 hour.

After dyeing, the liquor is run off, the residue rapidly sucked and water freely admitted. The first rinsing water, which will be strongly coloured, is run back into the dye-vat, and the cops are then thoroughly rinsed with lukewarm water until the latter remains quite clear. To the last rinsing liquor 3—5 oz acetate of soda per 10 gallons of water are added, and after this liquor has been allowed to act a short while, the cops are dried without another rinsing.

Immedial Blue on Cops.

For 100 lbs of cops.

First bath:

180	gallons water
4—8 lbs	caustic soda lye 75° Tw.
12—16 ,,	cryst. sodium sulphide
16—20 ,,	Immedial Blue.

For subsequent lots:

1 1/2—2 %	caustic soda lye 75° Tw.
8—12 %	cryst. sodium sulphide
8—12 %	Immedial Blue.

The cops are dyed for about 1 hour at the boil as described above. When the dyeing is finished, the liquor is well drawn off the cops by means of the vacuum pump, and the cops are once more pressed off by air pressure in order to thoroughly remove the liquor, of which as little as possible should remain in the cops.

The steaming of the cops may be carried out in the machine also, the supply of steam and air (by the injector) being so arranged as to allow their entering direct into the cavity of the cop carrier and penetrating the goods by application of sufficient pressure.

Frequently the cops are not steamed in the dyeing machine, but the cop carriers are after dyeing and extracting (see page 215) taken into a small separate steam-chest, into which steam and air are introduced by means of an injector.

This steam-chest should be provided with a false bottom for letting off the condensed water and also with a steam-pipe to heat it before steaming.

The steaming lasts about $^1/_2$ hour; it should not be unduly prolonged, the colours although becoming brighter losing in fastness to washing.

Note:

All other dyeings are produced on cops exactly as described on pages 204—217 and 249—257 respectively.

Dyeing Mercerised Cotton Hanks.

The dyeing is done practically in the same manner as in the case of ordinary cotton. Mercerised cotton however taking up the colours more rapidly, it is advisable to work in a bath which is not too hot and does not contain too much salt.

It is well known that mercerised yarns require less dyestuff, the difference amounting to 25 or 30 per cent against ordinary yarns.

Diamine Colours are generally dyed as follows:

The bath is prepared with
1 % soda ash,
1—2 % Turkey-red oil

and the requisite quantity of dyestuff. After abt. 1/2 hour's dyeing, add

for light shades:	2—5 % phosphate of soda
for medium and dark shades:	3—8 % cryst. Glauber's salt
for blacks:	15—20 % cryst. Glauber's salt.

The dye-baths for light shades should be at first lukewarm and, after addition of sodium phosphate, be heated to 120—140° F. It is advisable even for dark colours to begin dyeing below the boil, at 120—140° F, and only gradually raise to the boil after having added the Glauber's salt.

If for some reason it is not advisable to employ Turkey-red oil, the latter may be replaced by soap, in which case the addition of soda must be increased to 2—4 %

according to the quality of the water used. The action of Turkey-red oil is, however, so favourable that it should only be replaced in exceptional cases*).

Topping with basic dyestuffs is done in a cold bath noticeably acidulated with acetic acid.

Immedial Colours are dyed on mercerised yarn in the same manner as on ordinary yarn, the instructions given on page 227 being equally applicable for the dyeing of that kind of yarn. The quantity of sodium sulphide should, however, be increased by about $^1/_4$, whilst the addition of salt must be considerably diminished, $^1/_3$—$^1/_4$ of the quantity of salt required for ordinary yarn being sufficient.

Immedial Black, for example, is dyed on mercerised yarn as follows:

First bath:

For 100 lbs. of yarn:
10 lbs. soda ash
20 „ cryst. sodium sulphide
14—18 „ Immedial Black
20 „ common salt.

For dyeing subsequent lots in the old bath, about the following quantities, calculated on the weight of the goods, are used:

2 % soda ash
10 % cryst. sodium sulphide
7—9 % Immedial Black
3 % common salt.

In order to obtain the best lustre effect, care should be taken to keep the temperature a little lower than usual for the dyeing as well as for the aftertreating if such be required. A temperature of 160—175 ° F. is sufficient for dyeing and of 140—160 ° F. for the aftertreatment.

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*) Recently the so-called "Monopole" soap has also been used with advantage for dyeing mercerised yarns.

Instead of dyeing mercerised cotton, unmercerised cotton may also first be dyed with Immedial Black, rinsed, and then mercerised with caustic soda lye. As, however, at least $25^{0}/_{0}$ of colouring matter are economised by dyeing mercerised yarn, the lustre of the yarn being in no way deteriorated by dyeing with Immedial Black, mercerising before dyeing is in the majority of cases more advantageous, this being also the usual way of procedure.

The brightening of mercerised dyeings and also the production of the characteristic silk scroop are described in the appendix.

Basic Dyestuffs are principally used for the production of brilliant shades.

The method of working is exactly the same as that described for ordinary yarn on page 241. The mordanting baths, however, may be prepared with about $^{1}/_{4}$ less tannin and antimony. The dyeing is done in a cold bath well acidulated with acetic acid, or, in the case of very light shades, also in a soap bath, the dyestuff being added in portions.

The following dyestuffs are specially well adapted for the dyeing of mercerised yarns, as they also resist the subsequent acid brightening with acetic or tartaric acid.

For mercerised yarns, which are not submitted to this after-treatment, any of the colouring matters used for ordinary yarns may be employed.

Diamine Colours.

Yellow.

Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Fast Yellow FF
Diamine Yellow CP
Thioflavine S.

Thioflavine S is not quite so good as Diamine Fast Yellow FF, but is rather extensively used on account of its brilliant shade.

Orange.

Diamine Orange G
Diamine Orange D

Diamine Orange B
Primuline developed with Resorcine.

Red.

Diamine Rose all brands.
Diamine Brilliant Scarlet S

Diamine Fast Red F
Primuline developed with Beta-Naphtol.

Claret and Violet.

Diamine Bordeaux S
Oxy Diamine Violet B
Diamine Heliotrope B

Diamine Heliotrope O
Diamine Azo Blue 2 R
} developed with Beta-Naphtol.

Brown.

Diamine Brown 3 G
Diamine Brown B
Diamine Brown M
Diamine Catechine B
Diamine Catechine G

Cotton Brown A

Diamine Nitrazol Brown BD
Diamine Nitrazol Brown B
Diamine Nitrazol Brown G
Diamine Nitrazol Brown T
coupled with Nitrazol.

Blue.

Diamine Sky Blue
Diamine Sky Blue FF
Diamine Brilliant Blue G
Diamine Blue RW
Diamine Blue BG
Diamine Blue BX
Diamine Blue 3 R
Diamine New Blue R
Oxy Diamine Blue G
Oxy Diamine Blue R

Diamine Fast Blue C
Diamine Fast Blue CG
Diamine Steel Blue L
Diamineral Blue R

Diaminogene Blue BB
Diaminogene Blue G
} developed with Beta-Naphtol.

Diamine Azo Blue R
Diamine Azo Blue RR
Diamine Azo Blue 6B
} developed with Beta-Naphtol and Naphtylamine Ether N.

Green.

Diamine Green G
Diamine Green B
Diamine Dark Green N.

Black.

Diamine Jet Black SS
Diamine Jet Black Cr
Diamineral Black B
Diamineral Black 3 B
Diamineral Black 6 B
Oxy Diamine Black SA
Oxy Diamine Black UI
Oxy Diamine Black SOOO
Oxy Diamine Black BG
Oxy Diamine Black BM

Diamine Nitrazol Black B
Oxy Diamine Black A
coupled with Nitrazol

Diamine Beta Black B developed with Beta-Naphtol

Diamine Black BH
Diaminogene B
Diaminogene extra
developed with Beta-Naphtol or with Phenylene Diamine.

Grey.

Diamine Grey and the various black dyestuffs dyed in light shades.

Immedial Colours.

All the Immedial Colours and especially
Immedial Black FF
Immedial Black NB
Immedial Black NR

further

Immedial Direct Blue B
Immedial Sky Blue
Immedial Blue C
Immedial Blue CR
Immedial Bronze A
Immedial Brown B
Immedial Brown G
Immedial Dark Brown A.

Basic Dyestuffs.

Thioflavine T
Paraphosphine G and R
New Phosphine G
Tannin Orange R
Safranine all brands
Irisamine G
Tannine Heliotrope
New Methylene Blue all brands
Naphtindone BB
Indazine M
Methyl Violet all brands
Solid Green
Brilliant Green.

Colours resisting subsequent Mercerising.

Colours employed for dyeing yarn which is to be woven into pieces and then mercerised, must of course resist the process of mercerising.

The colours given in the following list possess this property. It must however be noted that the colours are apt to bleed if the material remains in the lye for some length of time; this may be best prevented by washing the pieces immediately after the passage through the lye, rinsing or souring them at once. After the souring, the pieces are thoroughly rinsed as usual in cold water.

Yellow.

Oxy Diamine Yellow GG
Diamine Fast Yellow B in light and medium shades
Diamine Fast Yellow FF
Primuline, treated with chloride of lime, also in deep shades.

Orange.

Diamine Orange G } in light and medium shades
Diamine Orange D }
Primuline, developed with Phenol, in light and medium shades.

Red.

Diamine Rose, all brands in pale shades
Primuline, developed with Beta-Naphtol
Paranitraniline, in moderately deep shades.

Claret and Violet.

Oxy Diamine Violet R }
Oxy Diamine Violet B } in light and medium shades.
Oxy Diamine Violet G }

Brown.

Immedial Brown B and G
Immedial Bronze A
Diamine Nitrazol Brown G, R D and T, coupled
Diamine Brown V, coupled.

Blue.

Diamine Sky Blue Diamine Blue RW	in light shades
Diamine Azo Blue R, developed with Beta-Naphtol, in light and medium shades.	
Immedial Blue C Immedial Blue CR Immedial Direct Blue B	in light and dark shades.

Green.

Diamine Green B Diamine Green G	in light shades
Diamine Green G, treated with chromium fluoride in light and medium shades.	

Grey and Black.

Immedial Black FF extra Immedial Black NG Immedial Black NB Immedial Black NR	in light and deep shades.

Hosiery Dyeing.

Diamine Colours.

All dyestuffs suitable for yarn dyeing are also adapted for hosiery dyeing, and the same instructions are applicable.

The boiling of the stockings previous to dyeing favours good results. If, however, previous boiling is to be dispensed with, the dyeing may be done at the boil for $^3/_4$ to 1 hour with the addition of 2 % soap and 2 % soda ash, thus combining the cleansing with the dyeing of the goods.

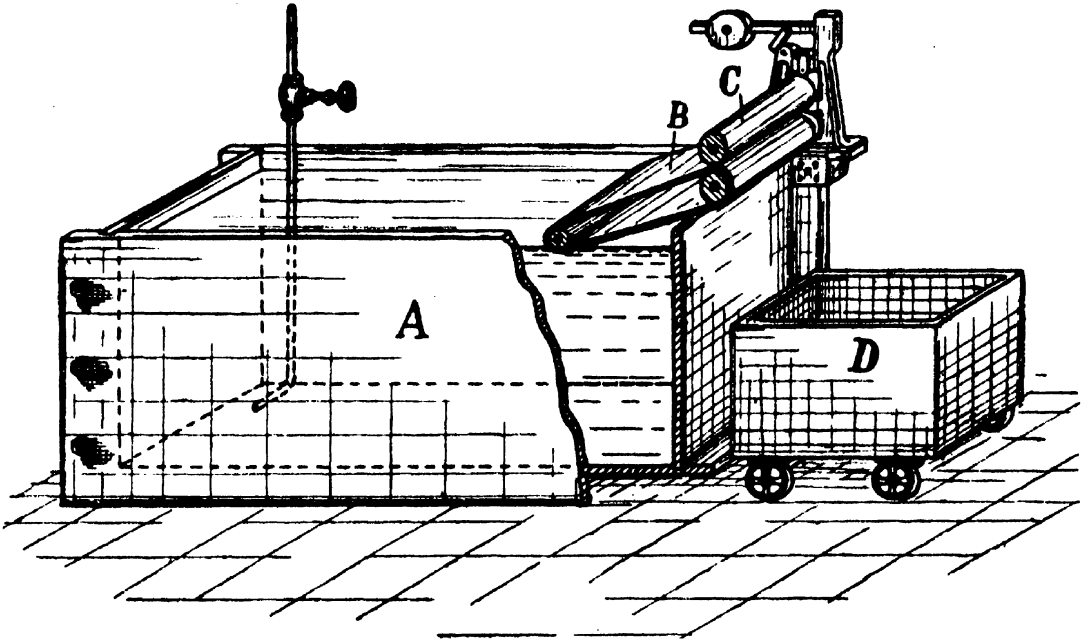
In following this method, however, a much larger proportion of colouring matter remains in the bath than in the case of dyeing with the addition of common salt or Glauber's salt, and it can therefore only be employed for light and medium shades, whilst the dyeing of dark shades or blacks is done to best advantage with the addition of Glauber's or common salt.

The dyeing of mercerised stockings is exactly analogous to the dyeing of mercerised yarns, and the description on page 261 is therefore equally applicable here.

Immedial Colours.

The Immedial Colours are dyed on stockings in the same way as on yarns.

The brands of Immedial Black which have proved of special advantage for dyeing hose are the NB, NR and NF brands, for the dyeing of which the following apparatus is recommended:



A is an ordinary dye-vessel in size as required.
B is an endless apron which is set in motion, after dyeing, to pass the stockings to
C the squeezing rollers.
D is a rinsing vat of any suitable shape, in which the stockings are rinsed immediately after squeezing.

The dye-bath is prepared for 100 lbs of stockings with:

200—220	gallons water
6	lbs soda ash
30	„ cryst. sodium sulphide
30	„ Immedial Black
50	„ common salt.

Subsequent lots are dyed with the addition of

2 °/o	soda ash
12 °/o	cryst. sodium sulphide
12 °/o	Immedial Black
6 °/o	common salt.

After having been well boiled out, the stockings are entered into the boiling dye-bath, in which they remain for about $^3/_4$ to 1 hour, being frequently turned.

The stockings are then spread in thin layers on to the apron by means of a pole and thus pass between the squeezing rollers.

The squeezers are covered with cotton cloth and work under sufficient pressure to thoroughly squeeze the goods.

Having passed through the squeezers, the stockings drop into the rinsing vat placed close by, and which may contain $1^1/_2$ to 3 oz of sodium sulphide per 10 gallons of water. The final washing must be done thoroughly in a suitable washing machine, the goods being treated in running water until perfectly clean, i. e. until the water runs off quite clear.

An aftertreatment with bichrome is only necessary if a bluer shade be desired.

In that case the stockings are treated for 25 or 30 minutes in a hot bath with:

3 % bichrome
3 % acetic acid

and ultimately rinsed.

The bath for the aftertreatment must be perfectly clear; any precipitate will be easily dissolved by the addition of some more acetic acid.

Whether the stockings are to be submitted to an aftertreatment or not, they ought for a final rinsing always to be passed through a bath containing 3—5 oz acetate of soda per 10 gallons of water. In this bath they are worked for a few minutes, then hydro-extracted and dried without another rinsing. This final rinsing bath becomes unnecessary when the stockings are submitted to some kind of alkaline brightening such as soaping.

All other shades of Immedial Colours are dyed the same way as Immedial Black, according to the instructions given for yarn dyeing.

The same may be said regarding the dyeing of mercerised hose with Immedial Colours.

Basic Dyestuffs.

The instructions given for yarn dyeing are also applicable for hosiery.

Directions for Dyeing the more important Shades on Loose Cotton, Sliver, Yarn and Hosiery.

Greys.

The cheapest greys of good fastness to washing and milling can be obtained with the various brands of Oxy Diamine Black.

The brands of chief importance for this purpose are:

Oxy Diamine Black A, SA, AM, FFC, RR, JEI and JW, these being the cheapest products, whilst
Oxy Diamine Black NF, BG, BM, BZ and SOOO are a little more expensive, but yield colours of better fastness to light.

Superior fastness to light can be obtained by using:

Diamine Grey G
Diamine Jet Black Cr, RB, SS, OO
Diamine Dark Blue B.

Greys fast to washing and milling, which also stand cross-dyeing with acids, are produced with:

Diamine Jet Black Cr, RB, SS, OO Diamine Dark Blue B	aftertreated with bichrome.
Diamineral Black B, 3 B and 6 B	aftertreated with bichrome and sulphate of copper.

Greys of excellent fastness to light, milling and acids are obtainable with the various brands of Immedial Black, which may be shaded according to requirement with either Immedial Bronze or Immedial Brown.

Creams.

The dyestuffs most suitable for cream shades are:

Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Fast Yellow FF
Diamine Yellow CP.

For shading to reddish yellow:
Diamine Orange G
Diamine Orange D.

For shading to greenish yellow:
Thioflavine S
Oxy Diamine Yellow GG.

The shades dyed with Diamine Fast Yellow A, B and FF are distinguished both by good fastness to light and excellent fastness to chlorine.

Yellow.

The brightest yellow shades are obtained with:

Thioflavine S
Oxy Diamine Yellow GG
Diamine Yellow CP.

Yellows fast to light and also very fast to washing are:

Diamine Fast Yellow A
Diamine Fast Yellow B
Diamine Fast Yellow FF.

Yellows fast to washing and milling, which also resist cross-dyeing with acids, are dyed with:

Primuline { diazotised and developed with Phenol
or
passed after dyeing through a bath of chloride of lime (Page 108),

Diamine Yellow N aftertreated with chromium fluoride,
Thioflavine T on a mordant of tannin and antimony.

Orange.

Brilliant orange shades are dyed with:

Oxy Diamine Orange G and R.

Considerably better fastness to light is obtained with:

Diamine Orange G and D

Diamine Orange B aftertreated with sulphate of copper.

Brilliant orange shades of very good fastness to washing with:

Tannin Orange, on a mordant of tannin and antimony.

Orange fast to washing and milling, and also resisting cross-dyeing with acids, is produced with:

Primuline, developed with Resorcine.

Mode and Olive Shades.

For the lighter mode and olive shades combinations are used of

Diamine Fast Yellow B, FF or A

Diamine Orange D or Oxy Diamine Brown G

Diamine Catechine 3 G or Diamine Brown R

Diamine Black BH or Diamine Dark Blue B.

For darker mode shades:

Diamine Fast Yellow B, FF or A

Diamine Brown M, R or Diamine Catechine G

Diamine Black BH, Diamine Dark Blue B,

or for very dark shades the better covering

Oxy Diamine Blacks.

For darker olive shades:

Diamine Fast Yellow B, FF or A

Diamine Green B, G or Diamine Dark Green N

Diamine Bronze G

Diamine Catechine G

Diamine Black HW.

For mode and olive shades of excellent fastness to light:

a) Diamine Fast Yellow B, FF or A
Diamine Fast Blue C or CG
Diamine Orange D or Diamine Catechine B.

b) Diamine Fast Yellow B, FF or A
Diamine Blue RW, Diamine Sky Blue FF, Diamineral Blue R
Diamine Orange B or Diamineral Brown G
aftertreated with sulphate of copper.

For mode and olive shades fast to washing and milling:

Diamine Nitrazol Brown G
Primuline
Diamine Blue NC
coupled with Nitrazol.

or

Diamine Fast Yellow B, FF or A
Diamineral Blue R or Diamine Blue RW
Diamineral Brown G or Diamine Catechine G and B
aftertreated with bichrome and sulphate of copper.

Mode and olive shades fast to milling, and also resisting cross-dyeing with acids:

Primuline
Diamine Black BH
Diamine Brown S
developed with Phenol, Resorcine, Beta-Naphtol or Phenylene Diamine.

Mode and olive shades of excellent fastness to milling and acids are obtained with combinations of:

Immedial Black
Immedial Brown
Immedial Bronze.

Brown shades.

Cheap brown shades are produced with
Oxy Diamine Brown G
Diamineral Brown G

Diamine Brown R
Cotton Brown A and N
Cotton Dark Brown BB and BM
Diamine Nitrazol Brown RD, BD and T
alone or shaded
with the various brands of Oxy Diamine Black.

For brown shades of better fastness to light:

Diamine Brown M, B and S
Diamine Catechine G, B and 3 G
Diamineral Brown G
shaded to the yellowish side with
Diamine Fast Yellow B, FF or A
or saddened with
Diamine Dark Blue B.

For Browns fast to washing and milling:

Diamine Nitrazol Brown G, B, T, BD or RD
Diamine Brown S
shaded to the yellowish side with
Primuline
or saddened with
Diamine Nitrazol Black B

coupled with Nitrazol.

For Browns fast to washing and milling and also very fast to light:

Diamine Brown M and B
Diamine Catechine G, B and 3 G
Diamineral Brown G
shaded to the yellowish side with
Diamine Fast Yellow A, B
or FF
saddened with
Diamineral Blue R
or
Diamine Dark Blue B

aftertreated with bichrome and sulphate of copper.

Browns fast to milling which also stand cross-dyeing with acids:

Diamine Jet Black OO, Cr, RB Diamine Nitrazol Brown T, G, B, BD, RD	coupled with Nitrazol.
Immedial Brown B or G Immedial Dark Brown A shaded, if necessary, with Immedial Black	dyed direct or coupled with Nitrazol.

Blues.

Direct Blues of bright shades are dyed with:

Diamine Sky Blue FF
Diamine Sky Blue
Diamine Brilliant Blue G
Diamine Blue BX, 2 B, 3 B
Diamine Blue BG and C 4 B
Diamine Blue 3 R
Diamine Azo Blue R and RR
Oxy Diamine Blue G and R.

For deeper shades of Blues and for Navies:

Diamine Blue BX and 3 R
Diamineral Blue R
Diamine Deep Blue R
Oxy Diamine Blue 3 R
Diamine Black BH
shaded according to requirements with
Oxy Diamine Violet or Diamine Red
or saddened with Oxy Diamine Black.

For shades of very special fastness to light:

Diamine Fast Blue C
Diamine Fast Blue CG

or

Diamine Sky Blue FF	aftertreated with sulphate of copper.
Diamine Blue RW	
Diamine Blue 3R	
Diamineral Blue R	
Diamine Brilliant Blue G	
Diamine New Blue R	
Diamine Dark Blue B	

By the aftertreatment with sulphate of copper the fastness to washing of the blue shades is also considerably improved.

For Blues fast to washing and milling:

Diamineral Blue R	aftertreated with sulphate of copper.
Diamine Dark Blue B	
alone or shaded with	
Diamine Brilliant Blue G	
Diamine Blue RW	
Diaminogene Blue BB	developed with Beta-Naphtol.
Diaminogene Dark Blue	
Diamine Azo Blue R, RR and 6B	
Diamine Black BH, BO, RO	developed with Beta-Naphtol or with Naphtylamine Ether N.
Diaminogene B	
Diamine Azo Blue R and RR	
Immedial Blue C and CR	
Immedial Sky Blue	
Immedial Direct Blue B.	

For Blues fast to washing and milling, and also resisting cross-dyeing with acids:

Diamine Black BO	developed with Beta-Naphtol or Naphtylamine Ether N
Diamine Heliotrope G,	developed with Beta-Naphtol
New Methylene Blue	on tannic acid and antimony
Methylindone	
Naphtindone,	on sumac and antimony.
Immedial Blue C and CR	
Immedial Direct Blue B.	

Pink Shades.

For direct dyeings:

The various brands of Diamine Rose shaded, according to requirement, with Diamine Brilliant Scarlet S, Thioflavine S, Diamine Fast Yellow A or Diamine Orange D.

These dyestuffs dyed in light shades have a good fastness to washing and milling.

For deeper shades of Pinks and higher degrees of fastness to washing and milling the following dyestuffs may be used:

Safranine
Rosazeine 6 G } on a mordant of tannin and antimony.
Irisamine G

The colours dyed with Rosazeine 6 G and Irisamine G are also fast to acids.

For Pinks of great brilliancy, although not fast to washing, the various brands of Eosines dyed direct, and Irisamine and Rosazeine dyed on an oil mordant (see page 150) are also used.

Red Shades.

For direct dyeings:

Diamine Red 4 B, 5 B, 6 B, 10 B
*Diamine Scarlet 3 B
*Diamine Fast Red F
**Diamine Brilliant Scarlet S.

The colours marked with one asterisk * resist the action of organic acids, and those marked with two asteriks ** also that of mineral acids.

For Reds fast to washing and milling:

†Primuline, developed with Beta-Naphtol
†Diamine Fast Red F, aftertreated with chromium fluoride
†Paranitraniline Red
Safranine on a mordant of tannin and antimony.

The colours marked † resist also cross-dyeing with acids.

For very bright shades of Scarlet, possessing no fastness to washing, but very fast to light:

Brilliant Croceïne M and the various products named on page 167 can be used.

Claret and Violet Shades.

For direct dyeings:

Diamine Bordeaux S and B
Oxy Diamine Violet B, R, G
Diamine Heliotrope O, G, B
Diamine Violet N.

For dyeings fast to washing and milling:

†Primuline, developed with Bordeaux Developer

†Primuline shaded with †Diamine Azo Blue RR } developed with Beta-Naphtol

Diamine Azo Blue R and RR developed with Naphtylamine Ether N

Tannin Heliotrope
†New Methylene Blue R and 3N
Methyl Violet, the various brands
} on a mordant of tannin and antimony.

The colours marked † resist also cross-dyeing with acids.

Violet shades of excellent fastness to light are produced with:

Diamine Blue 3R shaded according to requirements with Diamine Bordeaux S } aftertreated with sulphate of copper.

Green Shades.

For direct dyeings:

a) Diamine Green G and B
Diamine Dark Green N.

b) The various brands of Diamine Blue shaded with Oxy Diamine Yellow GG or Thioflavine S.

Deeper shades can be obtained by saddening with Diamine Black HW or Oxy Diamine Black D.

Green shades of very good fastness to light are produced with:

Diamine Sky Blue FF
Diamine Blue RW
Diamine Fast Yellow A or FF
aftertreated with sulphate of copper.

Green shades fast to washing and milling:

Diamine Green G aftertreated with chromium fluoride

New Methylene Blue GG
Thioflavine
on a mordant of tannin and antimony.

Solid Green
Brilliant Green
on a mordant of tannin and antimony.

The green colours dyed with New Methylene Blue GG and Thioflavine T also resist cross-dyeing with acids.

Blacks.

For cheap direct Blacks, fairly fast to milling, the following Diamine Blacks are suitable:

Oxy Diamine Black A, D, AM, AT, FFC, FL, SA, RR.

Better fastness to light is obtained with:

Oxy Diamine Black NF, NR, B, BG, SOOO, JEI, JB, JW.

The best fastness to light with direct dyed Blacks is obtained with:

Diamine Jet Black OO, Cr, RB, SS.

For cheap direct Blacks which are fairly fast to milling, and besides very fast to acids:

Oxy Diamine Black UI
Oxy Diamine Black SA.

For cheap Blacks of good fastness to milling:

1. Diamine Nitrazol Black B
Oxy Diamine Black A
Oxy Diamine Black JW
coupled with Nitrazol, if necessary with the addition of New Methylene Blue.

2. Diamine Black RO, BH Diamine Azo Black B	developed with Phenylene Diamine, or with Phenylene Diamine and Resorcine
Diamine Beta Black B and BB,	developed with Beta-Naphtol.

Blacks fast to milling and to light:

Diaminogene B Diaminogene BW and CCL	developed with Phenylene Diamine, Phenylene Diamine and Resorcine, or Phenylene Diamine and Beta-Naphtol,
Diamine Jet Black SS, Cr, RB, OO	aftertreated with bichrome,
Diamineral Black B, 3B, 6B	aftertreated with bichrome and sulphate of copper.

Blacks fast to milling and acids:

Diamine Black RO, BH Diaminogene B, BW, CCL	diazotised and developed with Phenylene Diamine, or with Phenylene Diamine and Beta-Naphtol.

Blacks fast to milling and acids and also resisting mordanting with bichrome and sulphate of copper:

Diamineral Black B, 3B and 6B	aftertreated with bichrome and sulphate of copper.

Blacks fast to acids, milling and light, which also resist all treatments of mordanting and finishing are obtained with

the various brands of Immedial Black.

III.

The Dyeing of Cotton Warps.

The Dyeing of Cotton Warps.

Diamine Colours.

Direct Dyeings.
Dyeings aftertreated with Metallic Salts.
Diazotised and Developed Dyeings.
Coupled Dyeings.
The Dyeing of Cotton Warps in the Size.

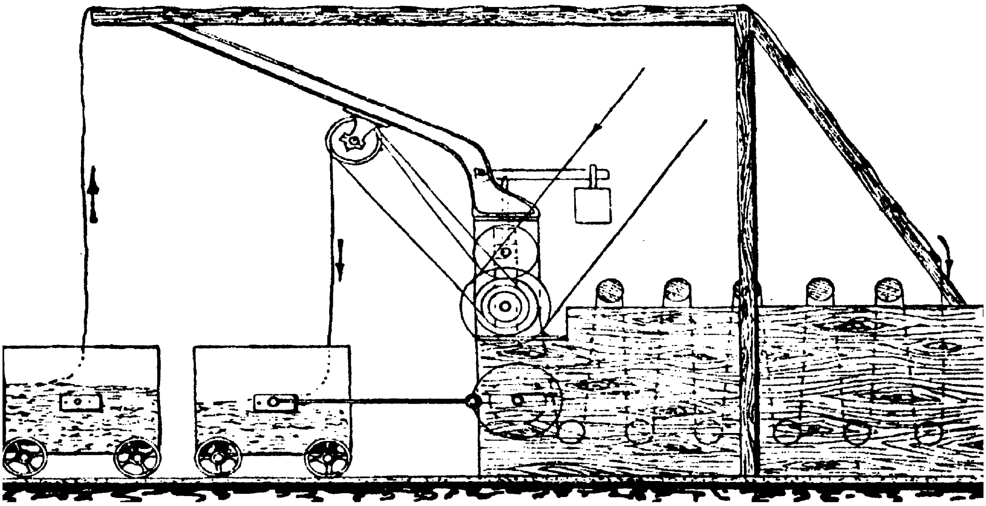
Immedial Colours.

Immedial Black.
Immedial Brown.
Immedial Direct Blue.
Immedial Blue.
Combination of Immedial Blue or Immedial Direct Blue with Indigo.

The Dyeing of Cotton Warps.

Direct Dyeings with Diamine Colours.

The process of dyeing depends upon the appliances at the disposal of the dyer. It generally consists of repeated passages, or sometimes only one passage, through a dyeing machine filled with dye-liquor. The following sketch shows the usual typical warp-dyeing machine.



Before dyeing, the warps are passed through a boiling bath, containing $^1/_2$ to 1 lb soda ash per 10 gallons of water.

The machine is filled with water until the lower guiding rollers are just submerged, and $^3/_4$ oz. soda ash per 10 gallons water are added in order to counteract the influence of the lime present in the water.

The colour solution required for dyeing a weight of warps is prepared in a separate vessel, along with a concentrated solution of Glauber's salt.

When dyeing, for instance, a grey shade on warps weighing about 1000 lbs,

2	lbs	Diamine Black BH
1	oz	Diamine Fast Yellow B
$3^1/_4$	„	Diamine Orange B
4	„	soda ash

are dissolved in 50 gallons water;

in another vessel

30 lbs desiccated Glauber's salt

are dissolved in 25 gallons water.

The dyeing takes place at about 195° F.

At the beginning of the dyeing operation, about one fourth each of the solutions of colour and Glauber's salt are added to the bath; the warps are sent through once, and the rest of the solutions are added in portions, the entire quantity being consumed in two passages.

For light shades, a single passage often suffices.

For dark shades, as many as 4 to 6 passages are given, while the amount of dyestuff to be dissolved is also increased according to the depth of shade. One half of the solutions of dyestuff and Glauber's salt is employed at the commencement, the remainder being added during the passage of the warps.

Compound shades, especially when light, are very easily produced and are always dyed in a fresh bath. Even when dyeing dark shades in a standing bath, it is not difficult to estimate the percentage of dyestuff it contains, and accordingly to determine the additional quantities of dyestuff required. If the exact shade should not be obtained, it may very easily be corrected in the sizing process.

For dyeing compound shades, only such dyestuffs should be chosen as exhaust at the same rate, dyeing to shade and dyeing level being thereby very much facilitated. In this connection the remarks on page 10 must be well observed.

In the case of dark colours, the warps are washed after dyeing; this is not necessary with pale shades, but must also be done if the warps are not sized immediately.

In this manner any shades may be dyed on warps. The necessary directions for selecting suitable combinations of colours may be found on referring to the various pattern cards of Diamine Colours on cotton yarn.

As to fastness, light shades satisfy all ordinary requirements, if the right dyestuffs are selected.

If in the case of dark shades special demands are made for fastness to washing, milling and acids, dyestuffs should be employed which may be fixed by an aftertreatment with metallic salts or by diazotising and developing or coupling, as circumstances permit.

Dyeings aftertreated with Metallic Salts.

The warps are after dyeing passed once at about 175° F. through a bath prepared with the required metallic salt, the following quantities of which are necessary for 100 lbs of warps:

2—4 lbs sulphate of copper
3 „ acetic acid.

3—4 lbs bichromate of potash
3 „ acetic acid.

1—2 lbs sulphate of copper
1—2 „ bichromate of potash
3 „ acetic acid.

1 1/2—3 lbs chromium fluoride
2—3 „ acetic acid.

These salts are dissolved in about 10 gallons of water, to which the acetic acid is also added. One half of the solutions is added at the beginning of the operation and the rest during the passage.

Diazotised and Developed Dyeings.

Diazotising and developing in warp-dyeing machines is principally resorted to for dark blues, browns, reds and blacks.

The dyeing is generally carried out as described for direct colours.

For a diazotised black, for instance, the dye-bath is prepared:

For 100 lbs of warps in 120 gallons of water with:

10 lbs Diamine Black BH previously dissolved in hot condensed water
15 lbs cryst. Glauber's salt.

One half of the dyestuff and Glauber's salt are added at the start and the remainder only after the goods have been given one passage through the boiling bath.

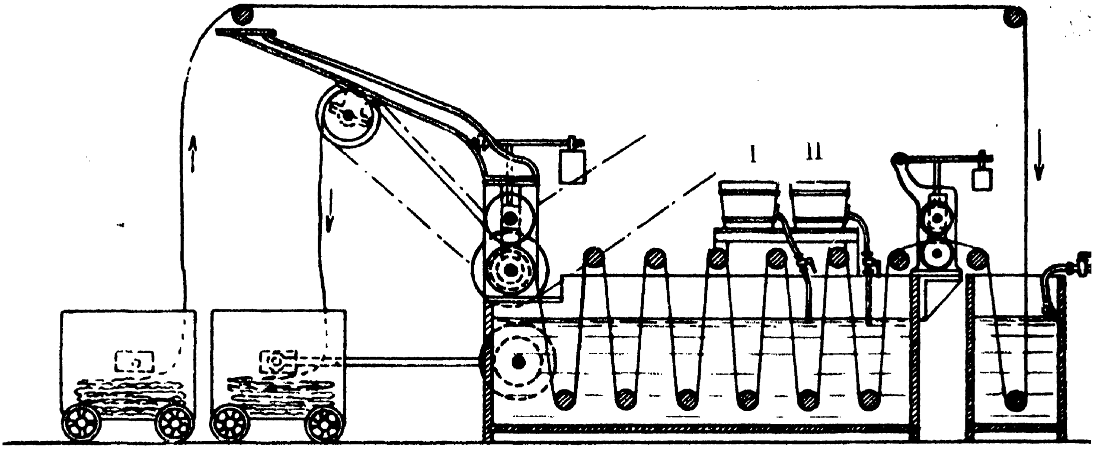
The warps, which have been previously boiled off, pass four times in all through the bath, but in cases where the desired depth of colour has not been obtained, two more passages are

For dyeing subsequent lots, the dye-bath is replenished with:

3 1/2—4 % Diamine Black BH } calculated on the dry weight of the warps to be dyed.
5 % cryst. Glauber's salt }

Diazotising.

The warps are diazotised in a second machine similar in construction to the dyeing machine, but provided with a small box for rinsing and also for cooling the warps before diazotising, as shown by the following sketch:



Two small wooden casks I and II are placed above the diazotising vat; one of these casks contains the dissolved nitrite, whilst the other is filled with dilute hydrochloric acid.

For 100 lbs of warps are used:

3 lbs nitrite of soda dissolved in
10 gallons water
and
10 lbs hydrochloric acid mixed with
10 gallons water.

One half of each solution is let off into the diazotising vat, and the warps are entered. During the passage,, which should be slow, the rest of the nitrite and hydrochloric acid are run into diazotising vat. The warps are well squeezed and laid off into trucks kept ready for this purpose.

Developing.

The machine with washing box attached, as used for diazotising, is also employed for developing, the warps passing through the washing box, between squeezing rollers, straight into the developing vat. The washing is effected by means of a continuous flow of water, care being taken that the water does not run direct on to the warps but flows in at the side.

For 100 lbs cotton will be required:

$^3/_4$ lb Phenylene Diamine
$^3/_4$,, soda ash.

Also in this case only one half of the solutions is added at the beginning and the rest during the passage.

After developing, the warps are well washed in a washing machine and then dried or at once sized while still wet.

In large establishments the diazotising machine is frequently combined with the developing machine. This arrangement admits of both processes being carried out in one operation.

Coupled Dyeings.

The coupling process is applied in warp-dyeing for the production of brown and black shades only. They are distinguished by their good fastness to washing and the low cost at which they can be produced.

The dyestuffs suitable for coupling are stated on page 111.

The dyeing takes place as described on pages 287/89, whilst the coupling is done in a second warp-dyeing machine which should not run too rapidly.

In order to couple effectively, a bath not containing too much water should be used, which at the commencement is charged with:

2 lbs Nitrazol C
$^1/_2$ lb soda ash
2 oz acetate of soda

for 100 lbs of warps.

For freshening up the bath, two solutions are prepared:

a) a solution of 2 lbs Nitrazol C
in 4 gallons water

b) a solution of $\begin{cases} 8 \text{ oz soda ash} \\ 2^1/_2 \text{ ,, acetate of soda} \end{cases}$
in 4 gallons water.

Equal quantities of each solution are added at intervals to the coupling bath during the passage of the warp.

After coupling, the warps are well washed in hot water.

Dyeing Warps in the Sizing Machine.

There are two methods by which the dyeing may be combined with the sizing:

a) The colour solutions are added directly to the size.

b) Troughs containing the requisite colour solution are arranged in front of the sizing machine; as a rule, however, only pale or medium shades are produced in this manner.

Dyestuffs can, however, only be added to such sizing pastes as are free from mineral matter and consist entirely of starch, fat or similar bodies.

If it be necessary to add weighting materials such as china-clay or magnesium salts to the size, it is better to dye the warp first and size it afterwards.

For sufficiently large lots, the size may be boiled together with the colour solution; small lots are, however, better prepared by adding the colour solution to the ready made size.

The coloured sizing paste is always used warm.

The following particulars will serve as an example, the quantities being calculated for 100 lbs of cotton warps.

Flax shade:

2 oz Diamine Catechine B
$1^{1}/_{2}$ „ Diamine Fast Yellow B
${}^{1}/_{16}$ „ Diamine Dark Blue B

are dissolved in about 3 gallons of boiling soft water.

Further:

30 gallons water
6 lbs rice flour
13 oz tallow
${}^{3}/_{4}$ „ stearine

are boiled and subsequently mixed with the colour solution.

The warps are passed dry, without previous boiling, once or twice through the sizing liquor and then on to the drying cylinder.

In a similar manner, any shades can be produced in sizing, as indicated in the following examples:

For 10 gallons of sizing paste prepared as above:

Pale Cream (Ecru)

${}^{1}/_{2}$ oz Diamine Fast Yellow B
${}^{1}/_{10}$ „ Diamine Orange B.

Slate (reddish)

${}^{5}/_{8}$ oz Diamine Black BH
${}^{3}/_{16}$ „ Diamine Brown M.

Bluish Grey

$1^{1}/_{2}$ oz Diamine Black BH
${}^{5}/_{16}$ „ Diamine Fast Red F.

Dull Olive

${}^{1}/_{2}$ oz Diamine Brown B
${}^{1}/_{2}$ „ Diamine Fast Yellow B
${}^{1}/_{4}$ „ Diamine Black BH.

Dark Blue

3 lbs Diamine Black BH
$6\frac{1}{2}$ oz Diamine Brown M.

Black

2 lbs $6\frac{1}{2}$ oz Oxy Diamine Black AM extra conc.
are dissolved in
5 gallons boiling water and mixed at about 140 ° F.
with
5 gallons size.

Dyeing Warps with Immedial Colours.

Immedial Black.

The dyeing of Immedial Black can be very easily effected in warp-dyeing machines of various makes.

The dyeing of warps is carried out in one or more passages, according to the construction and size of the machine, and the process of working may be varied as described in the following.

The warps are usually well boiled off previous to dyeing or simply passed through a warm bath of caustic soda lye of 6—$8\frac{1}{2}$ ° Tw.

If for any reason the warps are not boiled off, the dye-bath should be boiling gently whilst the warps are passing through.

After dyeing, the warps are well rinsed and in some cases also aftertreated with bichromate of potash.

The aftertreatment with chromium salts is of minor importance for warp-dyeing. Special care, however, must be taken to see that the warps are finally well washed, irrespective whether they are to be aftertreated or not, and in order to intensify the effect of rinsing it is important that the last rinsing water should contain some acetate of soda (as described below in detail).

If the warps are to be sized after dyeing, the acetate of soda may be added to the size instead of to the rinsing water.

I. Dyeing in the ordinary small Warp-Dyeing Machine by repeated passages.

The construction of the machine is similar to that shown on page 287.

First bath:

5 oz	soda ash	per 10 gallons of liquor.
2—2½ lbs	cryst. sodium sulphide	
5 oz	dextrine	
3 ,,	Turkey-red oil	
3—3½ lbs	Immedial Black	
3 ,,	desiccated Glauber's salt or common salt	

For each end the machine is fed up with the following quantities, which represent the weights actually absorbed:

½ %	soda ash	calculated on the weight of the warps.
8—9 %	cryst. sodium sulphide	
½ %	dextrine	
½ %	Turkey-red oil	
10—12 %	Immedial Black	
3 %	desiccated Glauber's salt or common salt	

The warps pass 2 to 4 times through the hot dye-bath. They are squeezed off after each passage and after the last squeezing are led into a rinsing bath, which is continually renewed by a steady current of fresh water. The warps are then again thoroughly washed.

It is a matter of frequent occurrence for the bath to become oversaturated with salt, and it is therefore advisable to frequently ascertain its strength by means of the hydrometer. The bath should not show more than 7—9° Tw.

Aftertreatment with Chromium Salts.

If an aftertreatment with chromium salts is at all desired, this should preferably be carried out with:

1 1/2 % bichromate of potash
1 1/2 % chrome-alum
3 % acetic acid,

two passages being given in a boiling bath and the addition made in two lots. The warps are afterwards well rinsed and sized.

Aftertreatment with Acetate of Soda.

Unless the warps are to be treated with an alkaline size, they should be finally passed through a short bath prepared with acetate of soda.

For this purpose the warp-dyeing machine is charged with:

5 oz acetate of soda per 10 gallons of liquor,

further

2—3 % acetate of soda, calculated on the weight of the goods,

being added for replenishing during the passage.

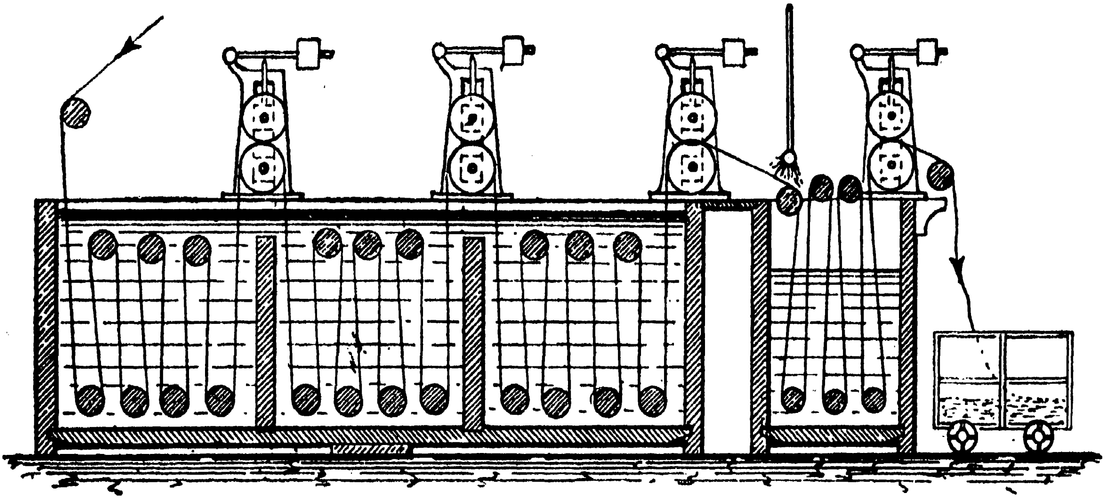
After this acetate of soda passage, the warps are squeezed off, but not rinsed, and dried or sized.

The acetate of soda may also be added to the size, 3—5 oz being sufficient for every 10 gallons.

II. Dyeing in large Warp-Dyeing Machines in one passage.

Before dyeing, the warps are boiled off in a machine, the first box of which contains weak caustic soda lye and the second boiling water, in order to remove the size.

Having been well squeezed off, they pass in their wet state into a dyeing machine constructed according to the following sketch.



This machine consists of a system of three boxes connected with each other, each having a capacity of 175—200 gallons. An additional fourth, and sometimes a fifth, box serves for washing.

The dye-bath is prepared as follows for the

First bath:

5	oz	soda ash	per 10 gallons of liquor.
1½	lbs	cryst. sodium sulphide	
2½	,,	Immedial Black	
2	,,	desiccated Glauber's salt or common salt	

While the warps are passing through this bath, the following quantities are gradually added:

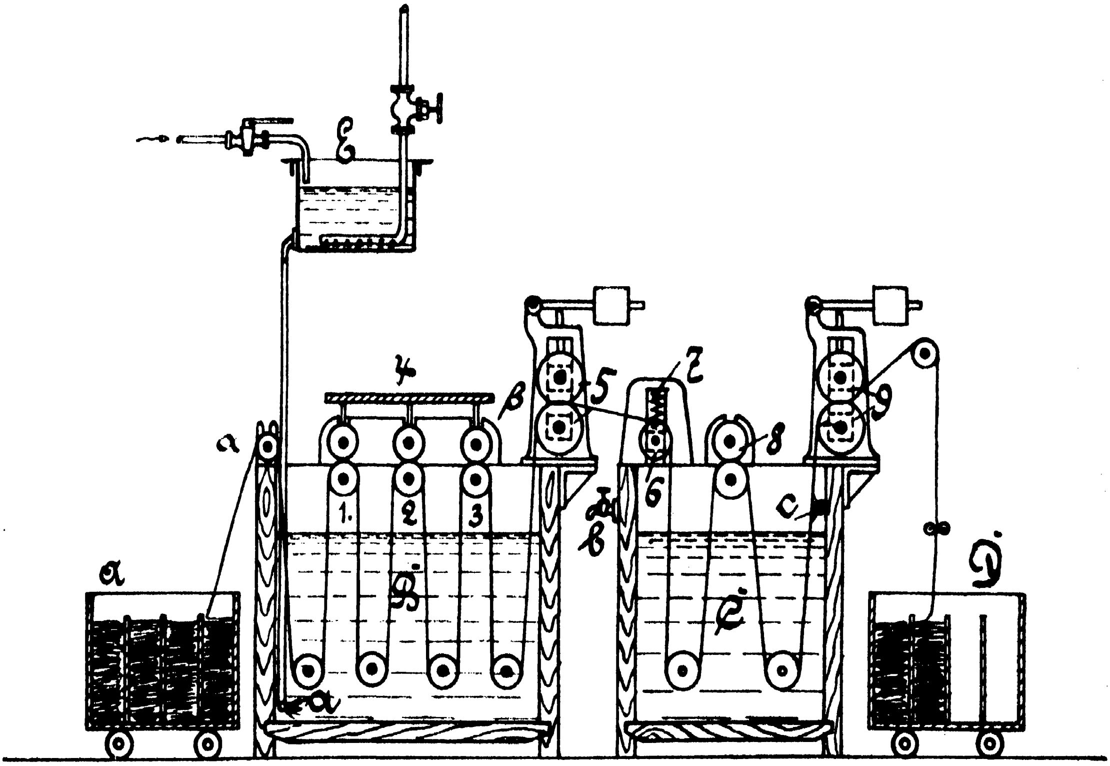
½ %	soda ash	calculated on the dry weight of the warps.
8–9 %	cryst. sodium sulphide	
11—12 %	Immedial Black	
3 %	desiccated Glauber's salt or common salt	

The warps pass through the boiling bath and are finally rinsed in the washing box by a continuous current of cold water.

After dyeing, the warps are once more thoroughly washed with hot water in a similar or in a smaller machine and then either chromed or only treated with acetate of soda as described on page 297.

The machine is capable of turning out about 1750--2000 lbs in a working day of 10 hours.

Another form of warp-dyeing machine, in which Immedial Black may also be dyed in a single passage, is shown in the following sketch.



A indicates a truck with 6--8 divisions, each containing one prepared warp.
B Dye box.
C Rinsing box.
D Truck.
E Tank with water and steam-pipe, for continuous feeding with the colour solution.

1, 2, 3 are pairs of wooden nippers which are uniformly weighted by 4.
5 are larger nippers made of iron and well wrapped with cloth.

6 is a wooden roller resting in the spiral springs 7. This roller serves the purpose of regulating the tension of the warps, as it gives both ways, according to the strain upon the warps.

8 is a lightly weighted wooden roller.

9 are iron nippers well wrapped with cloth.

a feeding pipe for the colour solution
b waste pipe and *c* feeding pipe for the rinsing water.

The driving of 9 is effected from 5 by means of a shaft and conical cog wheels.

The speed of the machine is so regulated that the warps travel the distance from α to β in 2 minutes.

The starting bath is charged approximately as follows:

175	gallons	water
$5^{1}/_{2}$	lbs	soda ash
40	,,	cryst. sodium sulphide
65	,,	desiccated Glauber's salt
62	,,	Immedial Black.

When dyeing in the standing bath, the continuous feed for four warps, No. 45 single, of about 100 lbs weight is:

20	gallons	water
2	lbs	soda ash
10	,,	cryst. sodium sulphide
8	,,	desiccated Glauber's salt
14	,,	Immedial Black.

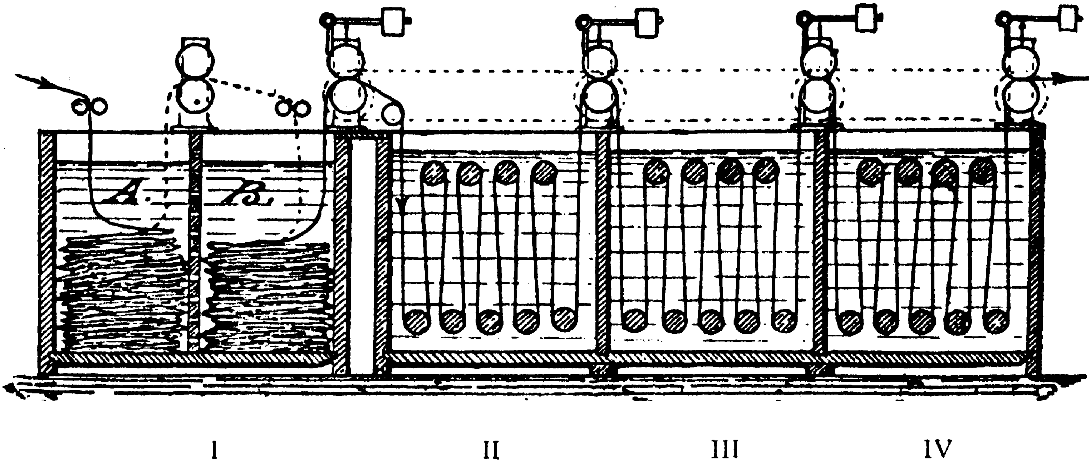
As soon as the warps have passed through the dyeing machine, they are transferred to another machine to be rinsed and after-treated with acetate of soda as described on page 297.

This machine turns out daily about 1300 to 2000 lbs.

III. Dyeing Warps by Submersion.

This machine, pretty extensively used for warp-dyeing, is also very suitable for Immedial Black; a pair of rollers must, however, be affixed for squeezing the warps.

The following description will serve to explain the sketch:



I is a large dye-box divided into two equal parts; each half consists of 4—6 perforated subdivisions, in which the warps are submerged.

II is a rinsing vat provided with well acting sprays (not shown in the sketch). The round rollers may be replaced by quadrangular or hexagonal rollers in order to effect a more thorough rinsing.

III and IV are boxes for rinsing and aftertreating.

By means of the small guiding rollers the warps are first deposited into *A*, passed from there between the squeezing rollers on to *B*, and back again.

The warps are dyed in 4 ends within 1—1 $^1/_2$ hour and are then entered from *A* or *B* into the rinsing box, after having been nipped between the squeezing rollers.

The warps are well boiled off previous to dyeing.

For dyeing say 400 lbs of warps, the bath is approximately charged with:

600	gallons	water
20	lbs	soda ash
48	„	cryst. sodium sulphide
120	„	desiccated Glauber's salt
64	„	Immedial Black.

The following additions are made for succeeding lots:

$^1/_2$ %	soda ash	calculated on the weight of the warps.
7—8 %	cryst. sodium sulphide	
9—10 %	Immedial Black	
3 %	desiccated Glauber's salt	

The aftertreatment with acetate of soda is carried out as described on page 297.

IV. Dyeing beamed Warps in Warp-Dyeing Machines.

Warps are frequently dyed on the beam in special machines with Immedial Black.

The dye-bath is charged for 100 lbs of warps with:

180	gallons water
12	lbs soda ash
24	,, cryst. sodium sulphide
32	,, Immedial Black
16	,, cryst. Glauber's salt,

and for succeeding lots with:

4 %	soda ash	of the weight of the warps to be dyed.
8 %	cryst. sodium sulphide	
10 %	Immedial Black	
3 %	cryst. Glauber's salt	

The water in the reservoir is charged with the quantities of soda and Glauber's salt indicated above and with one half of the requisite quantity of dyestuff and sodium sulphide, and then drawn from there by suction through the warp into the dye-vat proper. The remainder of the dyestuff and sodium sulphide is added direct to the dye-vat.

The dyeing is conducted at the boil, the liquor being drawn by vacuum and returned by steam pressure. The dyeing lasts from 1—$2^{1}/_{2}$ hours, according to the size of the warp, which should always remain covered by the dye-liquor.

As soon as the warp is dyed, it is lifted and immediately washed by forcing cold water through it. The first rinsing water, being rather strongly coloured, is allowed to run back into the machine, and the rinsing is repeated two or three times in tepid water, until the warp is perfectly clean. The warp is finally rinsed with a solution of acetate of soda as described on page 297.

V. Dyeing Warps in the Sizing Machine.

Warps may also be dyed in the sizing machine, if for this purpose three small wooden troughs be placed between the warp beams and the sizing trough. The first and second troughs are supplied with closed steam coils, and both serve for dyeing at the boil, the third trough being used for rinsing.

The two dye troughs are charged approximately with:

3—3½	lbs	Immedial Black	per 10 gallons.
12—16	oz.	cryst. sodium sulphide	
8	,,	soda ash	
3½	lbs	desiccated Glauber's salt	

For replacing the colouring matter absorbed by the fibre, a solution of about

9 %	Immedial Black	of the weight of the warps to be dyed
6 %	cryst. sodium sulphide	
3 %	Glauber's salt	

is run into the troughs.

The warps having passed through the dye troughs, which should be provided with well acting nippers, are rinsed in the third trough, squeezed, and sized at once with an addition of acetate of soda to the sizing paste.

Dyeing with Immedial Brown.

Immedial Brown is dyed on warps in exactly the same way as Immedial Black. The charges for the first bath for dyeing dark shades are approximately the same, and the quantities of dyestuff vary according to the desired depth of colour. Of sodium sulphide, however, only one third, or at the utmost, one half, of the weight of the colouring matter to be used should be employed.

The aftertreatment with sulphate of copper and bichrome or with Nitrazol is carried out as described on page 200.

An aftertreatment with acetate of soda is not required for the brown shades, which need only be well rinsed at the finish.

Dyeing with Immedial Direct Blue.

Immedial Direct Blue is also dyed in the same way as Immedial Black, the quantity of sodium sulphide must however be equal to the weight of dyestuff required. Regarding the quantities of dyestuff to be used and the aftertreatment with acetate of soda, the instructions given for Immedial Brown apply equally.

Dyeing with Immedial Blue.

The dyeing of cotton warps with Immedial Blue C may be carried out in exactly the same machines as described for Immedial Black, with the only difference that the warps must be very thoroughly squeezed after dyeing, but not rinsed.

I. Dyeing in the ordinary small Warp-Dyeing Machine by repeated passages.

The bath is charged with

1½—2 lbs Immedial Blue
13 oz—1 lb 10 oz cryst. sodium sulphide
3—6½ oz caustic soda lye 75° Tw.
per 10 gallons of liquor.

To keep the bath at the requisite strength, it is replenished during the passage of the warps with the following additions, which may be considered as the quantities actually consumed:

7—12 % Immedial Blue
5—10 % cryst. sodium sulphide
1½—2 % caustic soda lye 75° Tw.

The warp is passed through 2 to 4 times at the boil, according to the length of the machine, squeezed after each end, and finally steamed without previous rinsing.

II. Dyeing in large Warp-Dyeing Machines in one passage.

The dye-bath (starting bath) is charged per 10 gallons of liquor with:

13 oz to 1 lb 10 oz Immedial Blue
10 „ „ 1 „ 4 „ cryst. sodium sulphide
3—6 1/2 „ caustic soda lye 75° Tw.

One passage at the boil is sufficient. To replenish a standing bath, the quantities indicated for the same purpose on the preceding page should be used.

After dyeing, the warp is well squeezed and steamed without rinsing.

The Steaming of Warps.

The developing of the colour of the dyed warp to Blue by steaming is effected in a way similar to the method described for yarn. Attention must be paid to the warps being very well squeezed immediately after dyeing. The effect of the nippers working with strong pressure may be increased by wrapping both rollers well with cotton cloth. The warps after squeezing are laid off separately, wrapped in cotton cloth, and steamed, or hydro-extracted previous to steaming if the squeezing has not been done well. The warps are placed for steaming alongside of each other into the steam-box on a false bottom of laths, which is fixed midway between the bottom and the top of the box. To avoid spots caused by drops of condensed steam, it is advisable to heat the steam-box previously and to cover the warps with cloth.

A steam-box or cylinder holding 100 lbs of yarn in the hank is suitable for steaming 200 lbs of warps (of twisted yarn).

The steaming should last one hour. The colour is then completely developed and the warps may then be finally rinsed, first in warm, and then in cold, water.

For details of steaming see page 129.

The developing of the blue is frequently effected by placing the hot warps well squeezed, just as they leave the dyeing machine, into a skep or truck lined with sacking, and leaving them well covered for 8—10 hours or over night in a room heated to 105—140° F.

The developed warps are finally rinsed as above indicated.

III. Dyeing beamed Warps in Warp-Dyeing Machines.

The first bath is prepared for 100 lbs of warps with:

180	gallons water
6—8	lbs. caustic soda lye 75° Tw.
8—12	,, cryst. sodium sulphide
16—20	,, Immedial Blue.

For continuing in the same bath, add:

1½—2 %	caustic soda lye 75° Tw.
6—8 %	cryst. sodium sulphide
8—12 %	Immedial Blue.

The warps are dyed one hour at the boil, the liquor being drawn by vacuum and returned by steam pressure.

After dyeing, the beam is lifted and the adhering liquor drawn off it, first by vacuum and then by air pressure, so that it may retain as little dye-liquor as possible.

The steaming of the warps is also done on the beam, and the admission of both steam and air (by means of the injector) is so arranged that both enter direct into the central cavity of the beam and penetrate the warp thoroughly with the aid of sufficient pressure.

If the warps be too bulky, and should thus make penetration difficult, it is advisable to place the whole beam in a small well covered box and to blow the steam both into the interior of the beam and also into the steam-box.

Combination of Immedial Blue or Immedial Direct Blue with Indigo on Cotton Warps.

Warps which are to be bottomed with Immedial Blue or Immedial Direct Blue and then topped with Indigo, are first dyed as described on the preceding pages 304—306, and then rinsed and topped with Indigo in the vat.

IV.

The Dyeing of Piece-Goods.

The Dyeing of Piece-Goods.

Preparing the Goods.

Direct Dyeing with Diamine Colours.

- Dyeing in the Open Vessel.
- Dyeing in the Jigger.
- Dyeing In the Padding Machine.
- Dyeing in the Padding Machine with simultaneous Finishing.
- Dyeing in the Continue Machine.

Dyeings aftertreated with Metallic Salts.

Diazotised and Developed Dyeings.

Coupled Dyeings.

Dyeing with Immedial Colours.

- Immedial Black.
- Immedial Direct Blue.
- Immedial Sky Blue.
- Immedial Blue.
- Topping Immedial Blue or Immedial Direct Blue with Indigo.
- Immedial Brown.
- Grey and Mode Shades.

Topping Diamine Colours and Immedial Colours with Basic Dyestuffs.

Dyeing with Basic Dyestuffs.

Dyeing with Acid Dyestuffs.

Dyeing with Paranitraniline and Nitrazol.

Dyeing Mercerised Piece-Goods.

Dyestuffs yielding Shades Fast to Storing.

Dyeing Cotton Pieces with Wool or Silk Shots.

Dyestuffs for producing the more important Shades on Piece-Goods.

Dyeing of Piece-Goods.

Preparing the Goods.

The way in which the pieces are prepared before dyeing depends entirely on the character of the goods and on the purpose for which they are intended to be used.

For the majority of piece-goods, the first operation is singeing, which is followed by boiling in alkaline liquors (bowking). The pieces are thereby freed from size and at the same time of many impurities and motes which would otherwise unfavourably influence the appearance of the finished goods.

For pale and very brilliant shades, the goods are usually bleached after having been boiled off.

Most pieces are dyed and bleached in the rope. Only a few special articles such as velveteens and other heavy goods are subjected to these operations in full width, in which case either specially constructed machines or jiggers are used.

Cotton satteens and similar cloths are prepared for dyeing by boiling in the crabbing machine and subsequently steaming on perforated cylinders.

Cheap linings intended for blacks are frequently not boiled off at all, but dyed in the grey state after singeing.

Direct Dyeing with Diamine Colours.

Piece-goods may be dyed

a) in the open vessel,
b) in the jigger,

c) in the padding machine,
d) in the padding machine with simultaneous finishing,
e) in the continue machine.

a) Dyeing in the Open Vessel.

Tensily woven, broad fabrics and pieces which cannot be dyed in the jigger are most frequently dyed in the open vessel, e. g. crepons and heavy qualities of velveteens, the latter being dyed in boxes specially constructed with openers and appliances for cuttling.

The quantity of water should be about 20—30 times the weight of the goods to be dyed. All the additions, details of which are given on page 7 of the introduction, are made into the partition which is separated from the main part of the vessel by a perforated wall. The goods are allowed to run about 1 hour at the boil and another $^1/_4$ hour with the steam shut off, in order to feed in the cooling bath.

Regarding the additions to be made for dyeing in a standing bath see pages 8 and 9.

b) Dyeing in the Jigger.

The jigger is the machine most extensively employed for dyeing cotton piece-goods; it admits of working expeditiously and easily with a small volume of dye-liquor.

According to the weight of the goods, dyeing on the jigger requires $^3/_4$—$1\,^1/_2$ hours, the goods running at an average speed of about 30—60 yards per minute. A quicker movement is not advisable, especially when handling large rolls.

Under normal conditions, the quantity of liquor amounts to about twice the weight of the goods to be dyed, but may be even less for large rolls.

Soda and salt are added according to the depth of the shade to be dyed and according to the volume of liquor employed.

For light shades:

3 oz soda ash
5—8 ,, cryst. Glauber's salt
per 10 gallons of liquor

for medium shades:

3 oz soda ash
8 ,, —1 lb cryst. Glauber's salt
per 10 gallons of liquor

for dark shades:

3 oz soda ash
1 $^1/_2$—2 lbs cryst. Glauber's salt
per 10 gallons of liquor

are used.

For light shades the liquor should be as dilute as possible. Dyeing is commenced at 120° F. with soda and dyestuff alone. After 4 passages, the Glauber's salt is added, divided for two ends, and two to four passages more are given at about 175° F.

Very light tints are dyed without any Glauber's salt but with soda and 1 $^1/_2$—3 oz Turkey-red oil per 10 gallons of liquor only; the soda is frequently replaced by phosphate of soda (5 oz per 10 gallons of liquor).

For medium and dark shades the bath is first boiled up with the soda. One half of the colouring matter is added in solution and the material entered. After the first passage the rest of the colour solution is added, and three more passages are given. Finally the Glauber's salt is added in two portions and the dyeing finished in 4—6 more passages with the bath at the simmer.

If the desired shade should not have been obtained, a dilute solution of the requisite dyestuff is added, for which purpose the level dyeing dyestuffs mentioned on page 10 are principally recommended.

For dyeing goods which are not easily penetrated, a little more soda is used, and in some cases, particularly for darker colours, 1 $^{1}/_{2}$—3 oz Turkey-red oil per 10 gallons of liquor are also added.

The repeated and prolonged use of a standing bath can only be recommended for dark shades and only as long as the liquor has not become turbid by the dissolved size and other impurities.

For replenishing the standing bath the following approximate additions are made:

$$\left.\begin{array}{r}\text{$^{1}/_{4}$ of soda ash}\\ \text{$^{2}/_{3}$—$^{3}/_{4}$ of dyestuff}\\ \text{$^{1}/_{4}$ of Glauber's salt}\end{array}\right\}\begin{array}{c}\text{of the quantities}\\ \text{used for the first}\\ \text{bath.}\end{array}$$

For controlling the strength of salt in the dye liquor the hydrometer is used. The bath should stand at about 6—7° Tw. at a temperature of 60° F. for dark shades; see also page 9.

c) Dyeing in the Padding Machine.

The padding machine is chiefly used for pale and medium shades.

Padding machines with either two or three rollers are employed; those with three rollers give the same effect as those with two but with fewer passages.

The trough of the padding machine is best made of wood. In machines with two rollers it holds some 12 or 15 gallons, whilst the capacity of the trough of a three roller machine is nearly 25 gallons. The bath is heated either by an open or by a closed steam pipe and is prepared for pale shades with the requisite quantity of colouring matter and:

$$\left.\begin{array}{l}\text{3 oz soda ash}\\ \text{5—8 „ cryst. Glauber's salt}\end{array}\right\}\begin{array}{c}\text{per 10 gallons}\\ \text{of liquor,}\end{array}$$

whilst for medium shades the quantity of soda ash is diminished to 1 $^{1}/_{2}$ oz and that of Glauber's salt increased to 13—16 oz per 10 gallons of liquor.

After half the requisite colour solution and soda has been added, the bath is heated to about 115° F. and one passage is given. The rest of the colour solution is then added with sufficient water to bring the liquor up to its original height for the second passage. The temperature is then raised to about 140° F., the Glauber's salt added, divided for two ends, and after two more passages a swatch is taken off for matching.

For medium shades the temperature is raised to 175° F.

The dye-baths are rarely used a second time.

For dyeing self shades any of the Diamine Colours may be used in the padding machine without trouble, whilst compound shades are best dyed with the following dyestuffs only, which combine well with each other.

Thioflavine S
Oxy Diamine Yellow GG
Diamine Fast Yellow B and FF
Diamine Fast Yellow A
Diamine Yellow CP
Diamine Orange D
Diamine Orange G
Oxy Diamine Orange G
Diamine Rose BD and GD
Diamine Red 4B
Diamine Red 10B
Diamine Brilliant Scarlet S
Diamine Bordeaux B
Diamine Heliotrope G, B and O
Diamine Catechine B, G and 3G
Diamine Brown S, M and R
Diamine Green G, B
Diamine Dark Green N
Diamine Sky Blue FF
Diamine Sky Blue
Diamine Blue RW
Diamine Blue 2B and 3B
Diamine Azo Blue RR
Diamineral Blue R
Diamine Fast Blue C and CG
Diaminogene B
Diamine Black BH
Diamine Dark Blue B
Diamine Jet Black
Oxy Diamine Black } all brands for pale and medium shades.

d) Dyeing in the Padding Machine with simultaneous Finishing.

This method is chiefly used for pale shades and for padding cotton prints.

The colouring matter, which is dissolved in condensed water, is added to the hot finishing paste, the dyeing and finishing operations being thus combined.

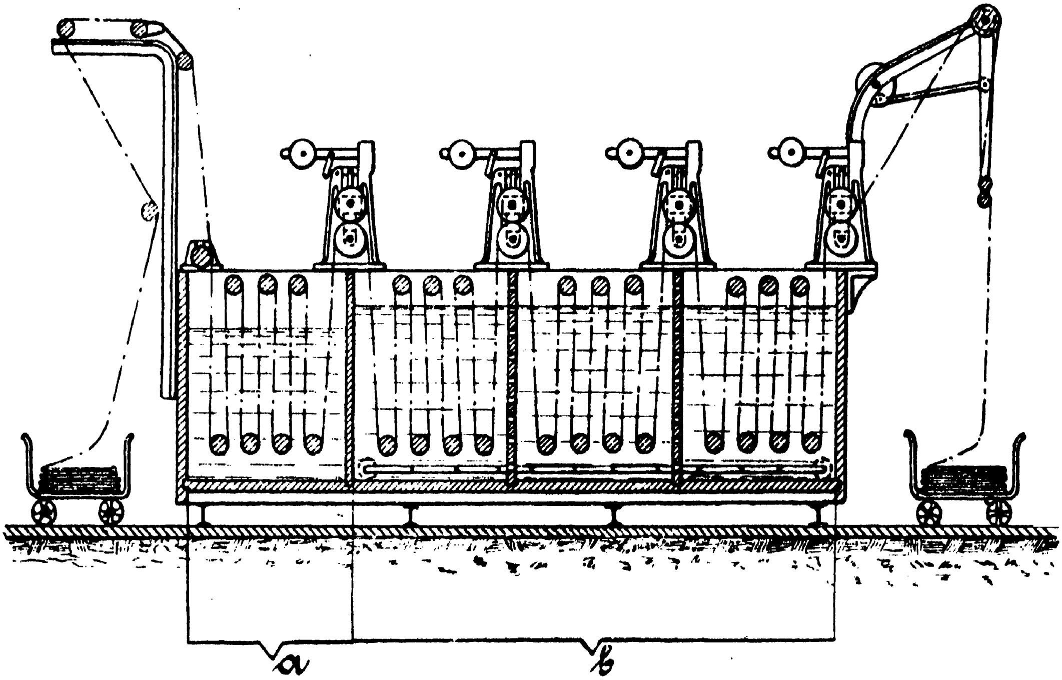
The dyestuffs recommended on the preceding page for dyeing in the padding machine are used in this case also.

e) Dyeing in the Continue Machine.

This method has given excellent satisfaction in turning out large quantities of cloth in dark blue and black shades. Cheap, plain cambrics linenettes and similar linings are for instance, frequently dyed black in one passage in the continue machine.

The following description will explain dyeing with Oxy Diamine Black.

The annexed sketch of the machine used shows a combination of four compartments, each provided with squeezing rollers of metal, the uppermost being coated with rubber. Suitable openers are fixed at a reasonable distance from these squeezers. The liquor is heated by closed steam coils.



The grey goods are boiled in the first compartment *(a)* which is charged with 3½ lbs soda ash and freshened up during the passage with ½% soda ash of the dry weight of the goods. This bath rapidly turns brown and dirty owing to dissolved size and other impurities, and is therefore renewed twice daily.

The three dyeing compartments *b*, with a combined capacity of about 650 gallons of liquor, are charged with equal quantities of dye-liquor, at first with:

2 1/2 lbs Oxy Diamine Black AT or JB dissolved together with some soda } per 10 gallons of liquor

and replenished during the passage with:

5—5 1/2 % Oxy Diamine Black } of the weight of the goods to be dyed.

For a daily output of 100 pieces of about 2600 lbs weight, the additions required for keeping the bath at its full strength, viz:

143 lbs Oxy Diamine Black and
13 lbs soda ash are dissolved boiling in
130 gallons water,

and 1 1/2 gallons of this solution divided between the three compartments are added each time one piece has passed.

The speed of the machine is so regulated that the pieces remain about 3 minutes in contact with the liquor.*)

Having passed through the machine, the goods are laid off into a truck and then rinsed. It is advantageous to defer rinsing the pieces for a little while, but not too long, else it is less easy to clean them thoroughly.

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*) These machines are as a rule provided with a small automatic meter which rings a bell after each 100—130 yards, thus announcing when the colour solution is to be added. It is, however, not very important for the addition to be made regularly, since small deviations have no detrimental effect on account of the high concentration of the bath.

The dye-baths can be used continuously for many months and should be exhausted as far as possible before their renewal, by passing the goods through without adding fresh colour.

Dyeings aftertreated with Metallic Salts.

The aftertreatment with metallic salts can be carried out in the open vessel, the jigger or the padding machine, according to the general directions given on pages 65—68.

The goods are treated in the open vessel at 175—195 ° F. for 20—30 minutes, whilst two passages in the jigger or padding machine, in a boiling hot bath, are generally sufficient with the additions divided for each end. Dyeings to be aftertreated with sulphate of copper must be well rinsed after dyeing, so that the goods are well freed from alkali. Should the sulphate of copper bath become turbid, more acetic acid must be added. The goods must be well rinsed after the treatment with metallic salts.

Diazotised and Developed Dyeings.

The pieces are dyed as described for direct colours, and the diazotising and developing is carried out, according to the particular circumstances, in

the open vessel,
the jigger, or
the continue machine.

The method of working in the continue machine may be seen from the following example.

Dyeing Diaminogene Black in the Continue Machine.

For dyeing, a similar machine as shown on page 318 is used.

The first bath is charged with:

$^{3}/_{4}$ oz	soda ash	per 10 gallons of liquor;
$1^{3}/_{4}$—2 lbs.	Diaminogene B	
5—$6^{1}/_{2}$ oz	Glauber's salt	

each compartment holding about 220 gallons of liquor, the charge for the three compartments together should be approximately:

3	lbs	soda ash
120—132	,,	Diaminogene B
20— 27	,,	Glauber's salt.

The soda is added to the bath first, and next the colour dissolved in hot water; after boiling up, the Glauber's salt is added.

The quantities given for the first bath cannot be considered as exactly suitable in all cases, small modifications having to be made according to the quality of the goods and the speed of the machine. As a rule, however, these quantities may be used in the beginning, the strength of the bath being increased or reduced according to the shade of the first pieces.

The additions to be made during the passage have to be calculated on the weight of the goods to be dyed and should be:

$^{1}/_{2}$ $^{0}/_{0}$	soda ash	of the weight of the dry goods.
$4^{1}/_{2}$—5 $^{0}/_{0}$	Diaminogene B	
2—4 $^{0}/_{0}$	Glauber's salt	

The solution may be prepared for a whole batch at once and be added either gradually, as required, or continuously. At the same time it is immaterial whether one or other of the dye boxes is charged with a little more or less of the replenishing liquor and whether the replenishing takes place at regular intervals or not, as long as the requisite quantity of colour is added or is made to run into the machine while the pieces are passing through. On account of the relatively high concentration of the dye-liquor small differences in this respect are of no importance.

During the dyeing process the liquor is kept at or near boiling temperature by means of a steam coil.

Instead of Diaminogene B alone, a mixture of equal parts of Diaminogene B and Diaminogene extra may be used for dyeing more bluish shades, the other ingredients remaining unaltered.

The goods may be rinsed in cold water immediately after dyeing, it is, however, better to let them lie for 1—2 hours before rinsing.

Diazotising and developing is also done with advantage in a continue machine.

Developed Black with Diamine Black BH.

For dyeing continuously with Diamine Black BH and for developing with Phenylene Diamine in the continue machine, the first bath is prepared with:

$3\,{}^1/_4$	lbs	soda ash
100—110	„	Diamine Black BH
20—25	„	Glauber's salt.

The strength of the dye-liquor is kept up with:

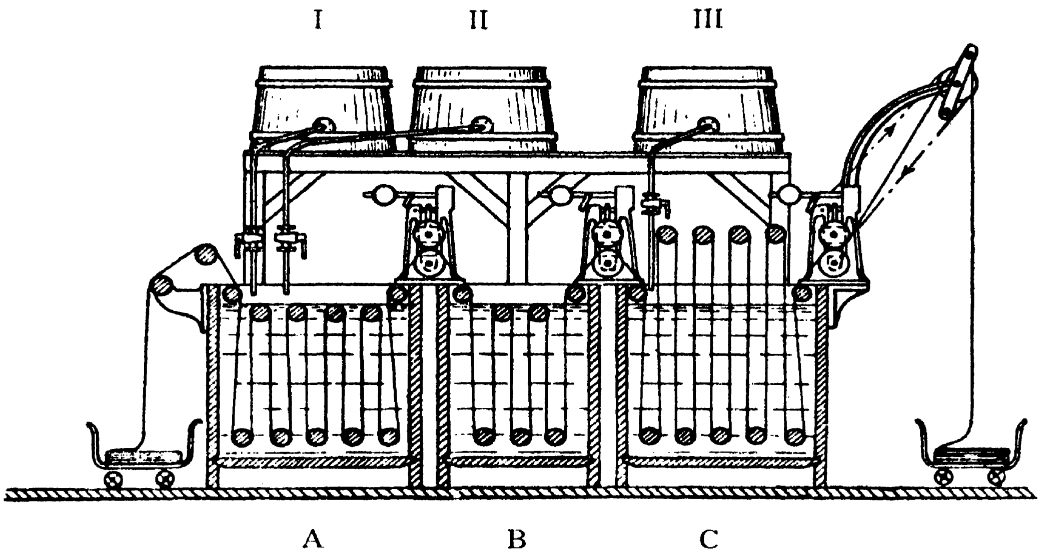
${}^1/_2\,{}^0/_0$	soda ash	calculated on the weight of the dry pieces.
$4—4\,{}^1/_2\,{}^0/_0$	Diamine Black BH	
$2—4\;{}^0/_0$	Glauber's salt	

If a dark blue is to be dyed by developing Diamine Black BH with Beta-Naphtol, the quantity of colouring matter is reduced according to the depth of the blue desired.

Diazotising and Developing in the Continue Machine.

The diazotising and developing of piece-goods in the continue machine has given excellent satisfaction. This system may therefore be greatly recommended when working on a large scale, the operations being easily carried out in one passage.

The following sketch illustrates the construction of the machine.



A is the diazotising box which contains the nitrite and hydrochloric acid, and is fed from the two reservoirs I and II.
B is the rinsing box containing acidulated water.
C is the developing box and is replenished from reservoir III.

The reservoirs are formed by tubs placed in an elevated position above the machine, which serve for feeding the latter continuously. No. I contains the nitrite solution, No. II dilute hydrochloric acid, both for feeding box A, whilst No. III contains the developing solution for feeding C.

The diazotising box is half filled with water, to which are added for the first charge:

2½ oz nitrite of soda
8 „ hydrochloric acid

per 10 gallons of liquor. The two tubs Nos. I and II are charged, according to the weight of goods to be diazotised, with:

1 % nitrite
3 % hydrochloric acid } of the weight of the dry material.

During the passage of the pieces through the machine, nitrite and hydrochloric acid are run separately from reservoirs I and II into the diazotising box, the flow of the two liquids being so regulated that they are absorbed as soon as the pieces have passed the machine.

The liquids need not flow continuously, but the taps of the reservoirs may be closed, if it is seen from the gauge glasses that in proportion to the diazotised goods too much nitrite or hydrochloric acid has been allowed to run out.

The proper condition of the diazotising bath may be judged by the smell, i. e., the bath should always smell perceptibly, but not pungently, of nitrous acid.

If the fumes of nitrous acid should cause inconvenience in the dye-house, a trouble which can hardly occur with correct working, a hood to carry off the fumes may be fixed above the diazotising box or it may be covered up tightly by a lid.

The washing box B is provided with running water, and some dilute hydrochloric acid is added from time to time during the passage, so that the rinsing water is always slightly acid.

The developing bath C is charged, according to the developer employed, as follows:

I. Developing with Phenylene Diamine.

For the first charge the developing box is half filled with water and per 10 gallons of liquor are added:

$^2/_3$ oz Phenylene Diamine
$^3/_4$ soda ash
previously dissolved.

The upper tub III is charged, according to the quantity of the goods to be developed, with:

0,5 % Phenylene Diamine
0,5 % soda ash
of the weight of the dry goods,

which are run into the developing box during the passage of the pieces. It is immaterial whether the solution runs in continuously or intermittently as long as the above mentioned quantity of developer is approximately added during the passage.

II. Developing with Phenylene Diamine and Resorcine.

The dyeing is done as above, but the first developing bath is charged per 10 gallons of liquor with:

1/3 oz Phenylene Diamine dissolved in water
1/3 „ Resorcine dissolved in water, with the addition of
3/4 „ caustic soda lye 75° Tw.

The reserve tub is made up for replenishing with:

1/4 % Phenylene Diamine dissolved in water
1/4 % Resorcine dissolved in water together with
1/2 % caustic soda lye 75° Tw.

of the weight of the dry pieces.

III. Developing with Phenylene Diamine and Beta-Naphtol.

The dyeing is also carried out as sub No. I, the first developing bath being charged per 10 gallons of liquor with:

1/3 oz Phenylene Diamine dissolved in water
1/2 „ Beta-Naphtol dissolved in water, with the addition of
3/4 „ caustic soda lye 75° Tw.

The reserve tub is charged for replenishing with:

1/4 % Phenylene Diamine
3/10 % Beta-Naphtol dissolved in water, together with
1/2 % caustic soda lye 75° Tw.

IV. Developing with Beta-Naphtol.

The first developing bath is prepared per 10 gallons of liquor with:

2 1/2 oz Beta-Naphtol dissolved in
2 1/2 „ caustic soda lye 75° Tw.,

and the reserve tub is charged for replenishing with:

0,6 % Beta-Naphtol
1 1/2 % caustic soda lye

of the weight of the dry pieces.

The dyed and rinsed goods are passed through the diazotising and developing box, remain unwashed for some time (about ½—1 hour), and are then rinsed. They may if required be finally soaped.

Diazotising and Developing in the Open Vessel.

The dyed goods, having been cooled by rinsing, pass first into the diazotising bath, where they run over the winch for 10—15 minutes; they are then rinsed for a few minutes in acidulated water, and, after the washing water has been run off, are developed with the requisite developer. The additions necessary for diazotising and developing are given in detail on pages 86—90.

Diazotising and Developing in the Jigger.

This method of working is usually carried out by diazotising in one jigger and rinsing in another; while the rinsing in the second jigger is proceeding, the developing bath is being prepared in the first, into which the material is passed without delay.

Diazotising.

Under normal conditions the quantities used are:

1½ % nitrite of soda } calculated on the weight of the
4½ % hydrochloric acid } dry pieces,

but these quantities are subject to alterations which depend on the size of the rolls to be diazotised.

If small rolls (say not more than 35—70 lbs of cloth) are to be diazotised and the quantity of water exceeds 100—120 gallons, the additions should be increased approximately to:

2½ % nitrite of soda } calculated on the weight of the
7½ % hydrochloric acid } dry pieces.

If, however, large rolls (350—450 lbs per roll) are to be diazotised, as is frequently the case,

1 °/o nitrite of soda	calculated on the weight of the dry pieces
3 °/o hydrochloric acid	

are quite sufficient.

The diazotising is always done cold in two passages, one half of each of the necessary ingredients being added for the first, and the rest at the beginning of the second, passage.

After diazotising, the goods are rinsed as detailed above, and then developed.

During the operations of diazotising and developing, the goods should be protected from direct rays of the sun in order to prevent spots and streaks.

Developing.

For developing small lots, the bath is prepared as described on pages 89—90.

For developing large batches, the jigger need only be charged with about $^2/_3$ of those quantities.

The developing is done cold in two passages, one half of the developer being added before the first, and the rest before the beginning of the second, passage.

The developed goods may be rinsed at once. It is, however, of advantage to leave the pieces batched up for one to two hours, or even longer. Dyed pieces developed with Phenylene Diamine are frequently passed, after rinsing, through a weak tepid soap bath, whereby the shades become bluer and brighter.

In large works it will prove of advantage to keep the developing baths for further use.

Coupled Dyeings.

For coupling Diamine Colours dyed on piece-goods, two passages through a padding machine or a jigger charged with Nitrazol or with diazotised Paranitraniline are sufficient. In both cases the first bath is prepared with:

3 1/4 oz	Nitrazol C	per 10 gallons of liquor,
2/3	soda ash	
	acetate of soda	

and the following quantities are added in two portions to keep up the requisite strength of the bath:

2—3 %	Nitrazol C
1/2—3/4 %	soda ash
0,2—0,3 %	acetate of soda

calculated on the weight of the material.

These quantities may be reduced by about one third for coupling large batches.

For particulars of working with Paranitraniline instead of Nitrazol see page 113.

After having passed through the cold coupling bath, the pieces are batched up or cuttled, and after 1/2—1 hour are rinsed as usual.

For shading purposes, basic dyestuffs may be added to the coupling bath. Black dyes for instance are usually shaded with 0,25 % New Methylene Blue N, GB or GG.

Production of Coupled Black in the Continue Machine.

The pieces are dyed as indicated for direct black (page 319), considerably smaller quantities of dyestuff however being used.

The first bath is prepared with:

$1\,^1/_4$—$1\,^1/_2$ lb	Oxy Diamine Black A or D	per 10 gallons of liquor,
$^3/_4$ oz	soda ash	

and for keeping up the strength of the bath $3\,^1/_2$ % Oxy Diamine Black calculated on the weight of the dry pieces are added during the passage.

After dyeing, the goods are rinsed and coupled in another box with Nitrazol, with the addition of some New Methylene Blue. The coupling bath is prepared as stated on the preceding page. The shading with New Methylene Blue may also be done subsequently.

The coupled dyeings possess good fastness to washing, and their cost of production is relatively very low.

The Dyeing of Immedial Colours on Piece-Goods.

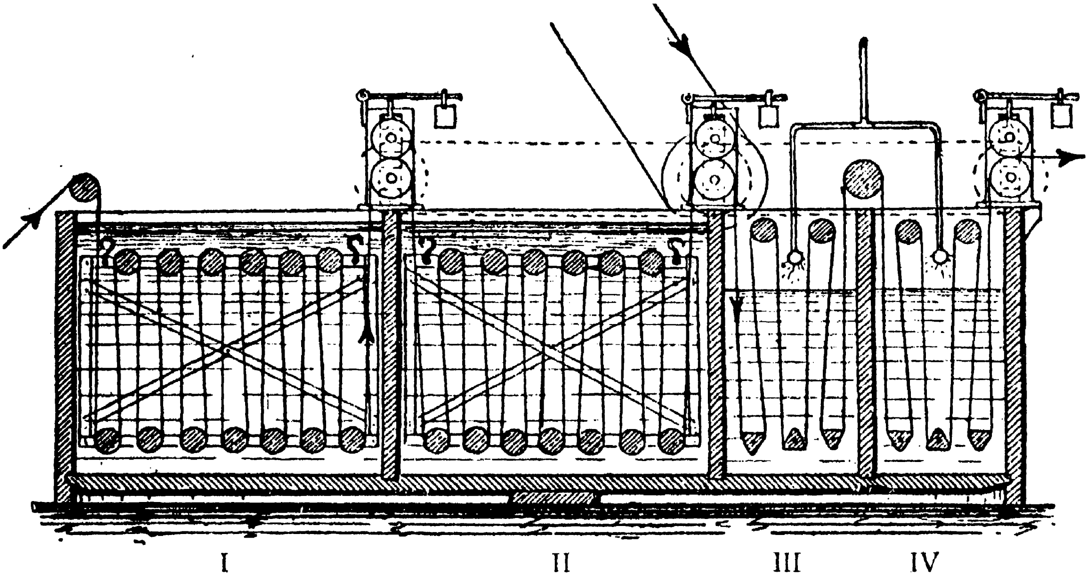
Immedial Colours may be dyed either in the continue machine, in the jigger, or in the padding machine. The most important point, to which careful attention should be paid, is to thoroughly squeeze the goods after dyeing, i. e. after the last passage. On the other hand it does not matter if the goods run in and out of the liquor during the passage through the continue machine or the jigger, as unlevelness can only arise through irregular squeezing at the close of the dyeing operation, or, in the case of black dyeings, by allowing the goods to lie unrinsed.

The Dyeing of Immedial Black.

Immedial Black is dyed in a continue machine or in a jigger, the former being best suited for lighter qualities, whilst the latter is adapted for all kinds of goods.

a) Dyeing in the Continue Machine.

The sketch below shows the construction of a suitable machine.



I and II are boxes for dyeing fitted up with a system of rollers.

The dividing board of the two boxes is perforated in order to allow the liquor to circulate.

The roller bearings are fixed in an iron frame which may be lifted at will.

III and IV are the usual rinsing boxes.

The boxes may be made of either wood or iron, but the inside rollers should always be made of iron. The squeezing rollers may both be made of wood, or the lower one of wood and the upper one of iron and, if required, coated with rubber; they are as usual covered with cloth.

A closed iron steam coil serves for heating the bath. The use of copper pipes or any copper fitting whatever is absolutely inadmissible.

For dyeing, the previously prepared goods are run once through the machine either dry or well mangled. The speed may be so regulated that the goods remain about 4 minutes in contact with the liquor.

The first bath is prepared with:

2½ lbs	Immedial Black*)	per 10 gallons of liquor.
1½ ,,	cryst. sodium sulphide	
5 oz	soda ash	
3 ,,	Turkey-red oil	
2 lbs	desiccated Glauber's salt or common salt	

The strength of the dye-bath is maintained during the dyeing by adding

11—12 %	Immedial Black*)	of the weight of the goods.
8— 9 %	cryst. sodium sulphide	
½ %	soda ash	
½ %	Turkey-red oil	
3 %	desiccated Glauber's salt or common salt	

As a rule the dyeing is conducted at the boil; strong boiling should, however, be avoided.

As soon as the pieces have left the machine, they are taken for final washing to a full-width washing machine, or a jigger fitted with sprays. Special attention must be paid to very thorough washing, otherwise the goods will have a tendency to rub.

In cases where the shades turn out too heavy, or where the goods cannot easily be washed clean, both objections may be rectified by adding a little sodium sulphide (3—5 oz per 10 gallons) to the first washing liquor.

Aftertreatment.

An aftertreatment of the goods with chromium salts is not required, the direct dyeings already possessing excellent fastness;

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*) For piece-dyeing the Immedial Black N B, N R and N F brands especially have been introduced with excellent results.

it is therefore resorted to in certain cases only, when some special shade of Black is wanted.

The shade becomes more bluish by an aftertreatment with bichrome and deeper when treated with chrome-alum.

The quantities are:

3 % bichrome
2 % acetic acid

or, if a more greenish shade is desired:

1 % chrome-alum
2 % bichrome
2 % acetic acid.

The aftertreatment may take place at the boil either at full width in a suitable box by one passage, or in the jigger, or in the padding machine by two passages.

The aftertreatment is followed by rinsing in cold water, the final rinsing being done in a solution containing 3—5 oz acetate of soda per 10 gallons of water. The goods are then taken out and dried without further rinsing.

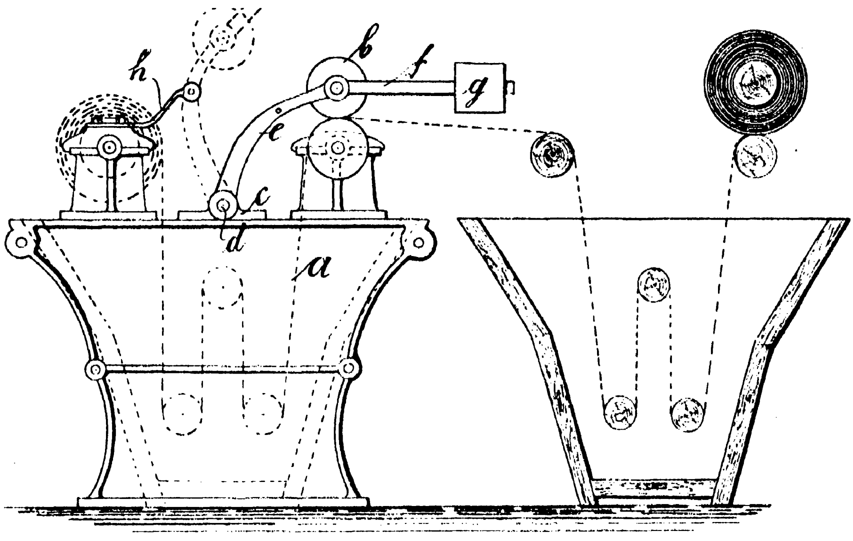
If the pieces are not treated with chromium salts they are rinsed in a solution of acetate of soda as above described.

If the pieces are to be starched, the acetate of soda may be added to the finishing paste.

b) Dyeing in the Jigger.

A jigger with squeezing rollers has proved the most useful machine for dyeing Immedial Black.

Below is a sketch showing the simplest and best way of fitting a squeezing roller to an ordinary jigger:



The narrow ends *(a)* of the jigger are fitted with two bearings *(c)* which carry a shaft *(d)*. To each end of the shaft, right and left, a lever *(e)* is immoveably affixed by means of a rabbet and wedge carrying the squeezing roller *(b)*. The levers *(e)* extend beyond the roller bearing through the arms *(f)*, which may be weighted with the weights *(g)*. When not in actual use, the whole arrangement is thrown back into the position shown by the dotted lines and is there arrested by means of a bolt which passes through an eye in arm *(h)*.

Jigger *a* is used for dyeing, the other jigger for rinsing only.

During the dyeing process, the squeezing roller remains stationary above the jigger, and the dyeing is carried out as usual; for the last passage, however, the squeezing roller is put into action, and the goods pass between the nippers straight into the rinsing bath without being batched.

The dyeing is started with the following charge:

½ lb soda ash
3½—5 lbs Immedial Black
2½—4 ,, cryst. sodium sulphide
5 oz Turkey-red oil
1—1½ lbs common salt

per 10 gallons of liquor.

In addition, the following quantities calculated on the weight of the goods are added:

9—12 % Immedial Black
8—10 % cryst. sodium sulphide.

The goods are passed 6—8 times through the boiling liquor and then through the squeezing rollers straight into a second jigger. After a thorough rinsing they may if required be aftertreated.

For further use, the old bath is replenished with:

½—1 % soda ash
9—12 % colouring matter
8—10 % cryst. sodium sulphide
½ % Turkey-red oil
1—2 % common salt

calculated on the weight of the goods.

The first rinsing water, to which sometimes 1½—3 oz sodium sulphide per 10 gallons of liquor are added, is used for replenishing the dye-bath.

When dyeing very large batches it is well to increase the quantity of sodium sulphide by one fourth and to make this extra addition just before the last end.

The aftertreatment with chromium salts and the rinsing with acetate of soda are carried out as described on page 332.

The Dyeing of Immedial Direct Blue.

The machines employed for dyeing Immedial Black may also be used for Immedial Direct Blue. When dyeing in the jigger, the starting bath is charged with:

3—11	oz	Immedial Direct Blue	per 10 gallons of liquor.
3	„	soda ash	
5—16	„	cryst. sodium sulphide	
1½	„	Turkey-red oil	
3—8	„	common salt	

Added to this are the following percentages which represent the quantities actually consumed:

3½—12 %	Immedial Direct Blue	calculated on the weight of the goods.
3½—12 %	cryst. sodium sulphide	

The bath is first charged with soda and Turkey-red oil and one half of the colouring matter dissolved with sodium sulphide. It is then boiled up, the material entered and after one end the rest of the dyestuff added. After a few more passages the salt is added and the dyeing finished within about ¾—1 hour.

At the conclusion of the dyeing operation the goods are squeezed off and at once rinsed in warm water. If no squeezing appliance is available, the goods are passed into a second jigger ready near by and thoroughly rinsed, but by this system a fairly large portion of the dye-liquor is lost. The goods must on no account be batched up as they leave the dyeing liquor, nor should they be left lying for any time if not well squeezed off and rinsed.

For subsequent lots the following additions are made, with variations according to the shade to be dyed:

3—12 %	Immedial Direct Blue
1 %	soda ash
3—12 %	cryst. sodium sulphide
½ %	Turkey-red oil
1—2 %	common salt,

the dyeing being carried out as described above.

Brighter shades are obtained by hot soaping with the addition of soda, or by an aftertreatment with

1 % sulphate of copper
1 % bichrome
3 % acetic acid.

It is, however, generally preferred to brighten the shades by topping with basic dyestuffs; these may also be added to the finishing paste.

The Dyeing of Immedial Sky Blue.

This may be effected either in the padding machine or in the jigger. The padding machine is to be preferred for lighter goods and the jigger for closely woven fabrics which are difficult to penetrate.

a) Dyeing in the Padding Machine.

The construction of the machine is described on page 339.

The goods receive 2—4 passages, being cuttled every time, but not batched.

The padding is carried out at a temperature of 105—115° F.

Charge for the first bath:

	for light,	for dark shades:	
Immedial Sky Blue	12—16 oz	2½ lbs	per 10 gallons of liquor
cryst. sodium sulphide	6½—8 ,,	13 oz	
soda ash	5 ,,	5 ,,	
Turkey-red oil	2½ ,,	3 ,,	
common salt	1½ lbs	2½ lbs	
and, in addition,			
Immedial Sky Blue	3 %	8 %	of the weight of the goods.
cryst. sodium sulphide	2 %	4 %	

Additions for dyeing in the standing bath:

	for light,	for dark shades:	
Immedial Sky Blue	3 %	8 %	of the weight of the goods.
cryst. sodium sulphide	2 %	4 %	
soda ash	1 %	1 %	
Turkey-red oil	$^1/_2$ %	1 %	
common salt	5 %	10 %	

After padding, the goods are well rinsed and aftertreated as described on page 234, if an increased fastness is desired.

b) Dyeing in the Jigger.

It is to be recommended to use exclusively a jigger fitted with squeezing rollers as described on page 333.

Charge for the first bath:

	for light,	for dark shades	
Immedial Sky Blue	13—16 oz	3 lbs	per 10 gallons of liquor
cryst. sodium sulphide	10 „	1 lb	
soda ash	5 „	5 oz	
Turkey-red oil	3 „	3 „	
common salt	16 „	3 lbs	
and in addition thereto:			
Immedial Sky Blue	3 %	10 %	of the weight of the goods.
cryst. sodium sulphide	3 %	6 %	

The dyeing is effected at 120—140° F., 4—8 passages being given according to the weight of the goods.

The dyeing process should not last longer than $^3/_4$—1 hour.

The goods are finally well squeezed by means of the squeezing rollers, cuttled and rinsed after some time has elapsed. They may, if desired, be aftertreated with bichrome and sulphate of copper as described on page 234, or topped with basic dyestuffs.

Additions for dyeing in the standing bath:

	for light,	for dark shades:	
Immedial Sky Blue	3 %	10 %	of the weight of the goods.
cryst. sodium sulphide	3 %	6 %	
soda ash	1 %	1 %	
Turkey-red oil	$^1/_2$ %	1 %	
common salt	5 %	10 %	

The Dyeing of Immedial Blue.

Immedial Blue may be dyed equally well in the continue machine, in the jigger or on the pad; the jigger and the pad are, however, most frequently used.

a) Dyeing in the Continue Machine.

The dyeing is completed in one run in the same machine as described for Immedial Black on page 330, except that the passage through the rinsing box is omitted. The goods are squeezed off as well as possible after dyeing and cuttled without washing.

The bath is prepared per 10 gallons with:

12 oz to 1 lb 10 oz Immedial Blue
10 ,, ,, 1 ,, 3 ,, cryst. sodium sulphide
3 ,, ,, - ,, 6 ,, caustic soda lye 75° Tw.
3 ,, ,, - ,, 5 ,, common salt.

The requisite strength is kept up by adding:

7—12 %	Immedial Blue	of the weight of the dry cotton,
7—12 %	cryst. sodium sulphide	
1½—2 %	caustic soda lye 75° Tw.	

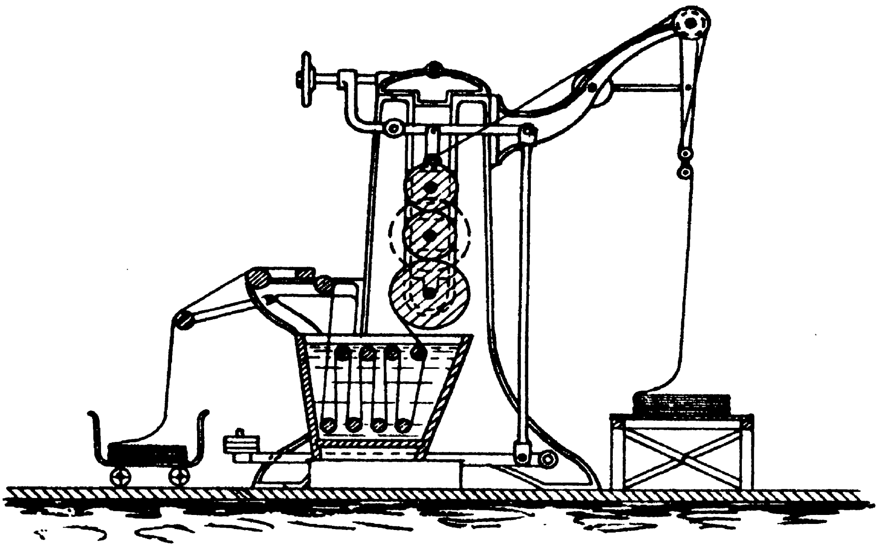
these quantities representing the percentages actually consumed.

b) Dyeing in the Padding Machine.

For this purpose an ordinary padding machine of any make may be used, as long as the nippers are not made of either copper or brass. Wooden, iron or rubber rollers are best suited.

The padding trough or roller box is made of either wood or iron. It should be fairly large and hold not less than 25—45 gallons of liquor. The small guiding rollers inside the box may be made of wood, running in iron bearings, or wholly of iron. They should be fixed in such a manner as to give the goods 4—5 up and down runs below the surface of the padding liquor.

This method of working is illustrated by the subjoined sketch.



The trough is charged per 10 gallons, according to shade, with:

1—2	lbs Immedial Blue
1—2	,, cryst. sodium sulphide
5—8	oz caustic soda lye 75° Tw.
½—1	lb common salt.

The bath is replenished by the addition of

6—12 %	Immedial Blue	calculated on the weight of the pieces.
6—12 %	cryst. sodium sulphide	
1½— 2 %	caustic soda lye 75° Tw.	

The previously boiled off goods are dyed at about 195° F. in 2—4 passages, as required. It is well to cuttle the goods after each passage, but not to batch them. After dyeing, the goods are steamed in their unwashed condition.

c) Dyeing in the Jigger.

Dyeing in the jigger offers the advantage over padding that the goods are dyed more effectively through.

As is the case with Immedial Black, any jigger fitted with squeezing rollers is suitable for Immedial Blue. In default of roller fittings the goods may be dyed in an ordinary jigger, in which case they must be taken from there straight on to a mangle or a padding machine in order that they may be well squeezed.

The starting bath is charged with:

10—18 %	Immedial Blue	calculated on the weight of the cotton.
10—18 %	cryst. sodium sulphide	
2— 4 %	caustic soda lye 75° Tw.	
3— 6 %	common salt	

For replenishing, the following quantities are added:

6—12 %	Immedial Blue	calculated on the weight of the cotton.
6—12 %	cryst. sodium sulphide	
1½— 2 %	caustic soda lye 75° Tw.	
3 %	common salt	

The goods are dyed at the boil in 6—8 passages and squeezed off without being rinsed.

After dyeing, the goods are steamed as described below.

Tensily woven fabrics which are not easily penetrated, as well as hard linen goods require an addition to the dye-bath of ½—1 % Turkey-red oil calculated on the weight of the goods, whilst no salt should be added and the time of dyeing be extended to 1¼—1½ hour. The quantities of colouring matter requisite for half linen goods and pure linen are much smaller than those necessary for cotton goods, the former requiring one third and the latter one half of the quantities indicated.

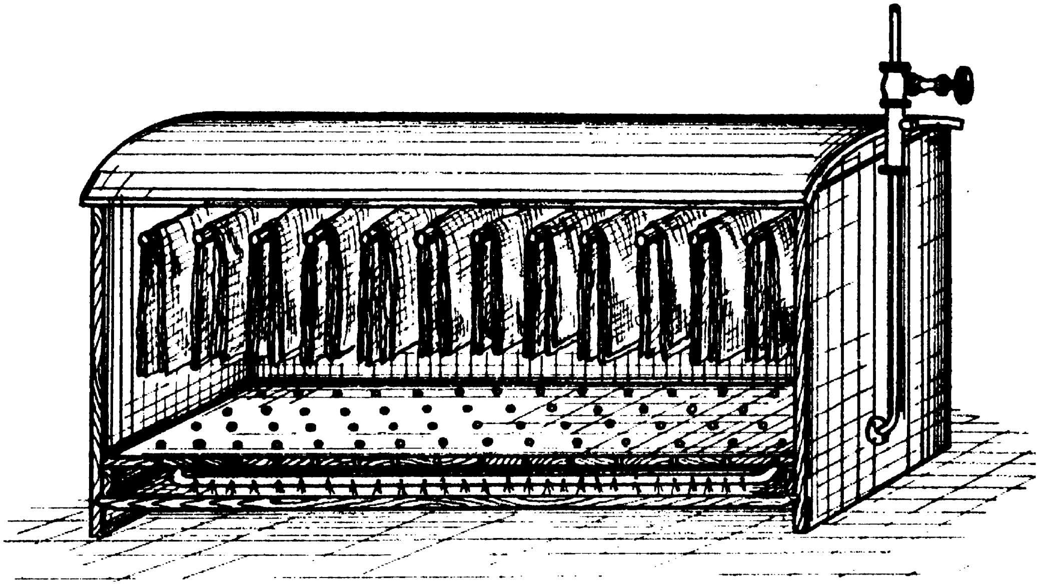
Steaming Immedial Blue Dyeings.

After dyeing, the pieces having been well squeezed (without being previously rinsed), are steamed without pressure for ½ hour. Any suitable steam-chest or wooden box fitted with a lid can be used for steaming, provided that both steam and air be admitted simultaneously.

The mounting of the air injector is described on page 130.

The steamers chiefly in use are:

- the common steaming cottage usually found in print works, in which the goods are suspended on moveable laths and steamed for ½ hour without pressure, but with admission of air, or
- a wooden steam-box as illustrated in the sketch below.



The steam-box should be somewhat wider than the goods which are put over laths side by side. The height of the box must be so calculated as to leave a space of not less than 4—6 inches between the goods and the perforated bottom. The steam is admitted near the bottom of the box in order to allow of the condensed water running off easily. The false bottom may also be covered with felting to prevent the goods from being spotted with water drops.

The cover of the steam-box should be arched and also slightly overlapping, being covered inside with felting (nailed on to laths so as to leave a space between the cover and the felting).

During the steaming, which lasts $^1/_2$—$^3/_4$ hour, great care must be taken to prevent any water from dropping on to the goods. The box may, however, at any time be opened and closed again, to enable the dyer to ascertain, if want of experience leaves him in doubt, whether the goods are thoroughly penetrated by the steam.

If the steam carry too much water, a remedy may be provided by the insertion at the bottom of the box of a closed steam coil, by which the box may be well heated previous to steaming.

After steaming, the goods are rinsed in warm water and topped with basic dyestuffs if desired.

In order to match Immedial Blue dyeings, an undeveloped pattern is taken for guidance, rinsed in cold water, passed through diluted acetic acid or a weak solution of alum, dried and kept without further rinsing. This treatment fixes the shade permanently, and the influence of the steaming always being exactly the same, it is sufficient to match the undeveloped dyeings.

Topping Immedial Blue and Immedial Direct Blue with Indigo.

Immedial Blue may be developed not only by steaming but also by the alternate action of the reducing agents in the vat and the oxidation in the open air.

The process is carried out by first dyeing the pieces with Immedial Blue in the manner described above. After being well squeezed, the pieces are cuttled up for a few hours and then topped in the Indigo vat (see page 179).

In a like manner to Immedial Blue, Immedial Direct Blue may be employed as a bottom for Indigo dyeings and moreover offers the advantage of yielding a dark blue shade already when dyed direct and that the pieces require no cuttling up for a few hours previous to topping in the vat.

Dyeing of Immedial Brown and Immedial Bronze.

Immedial Brown and Immedial Bronze are dyed on piece-goods in the same way as Immedial Black. The dyeing may also be effected in an ordinary jigger, the use of squeezing rollers being advisable, but not indispensable.

Immedial Brown may be combined at will with Immedial Black.

The colours are as a rule dyed direct, an aftertreatment with sulphate of copper and bichrome being only resorted to if particularly good fastness to light is required (see page 238).

Grey and Mode Shades produced with Immedial Colours.

A very extensive range of these shades may be obtained by combining the various Immedial Colours with one another, especially Immedial Brown, Immedial Direct Blue and Immedial Black, the method of dyeing being similar to that described on page 239.

These shades are best dyed in an ordinary jigger, which is quite serviceable for light shades, whilst for dark shades the additional employment of squeezing rollers, as described on page 333, is to be preferred.

The dye-bath is charged approximately with:

3 %	soda ash	of the weight of the goods to be dyed.
2—6 %	cryst. sodium sulphide	
1—6 %	of the various Immedial Colours	

The soda is first added to the jigger and then the dyestuff dissolved with sodium sulphide, the dyeing being effected at the boil in 4—6 passages.

For dark shades further 5—15 % Glauber's salt are added after the second passage.

Goods which are not easily penetrated require an addition besides of ½—1% Turkey-red oil calculated on their own weight.

Some of the Diamine Colours may also be added to the bath together with the Immedial Colours, the products most suitable being detailed on page 134. The dyed goods may, furthermore, be topped at will with basic dyestuffs.

The dyeings produced with Immedial Colours are in every case exceedingly fast to washing and to acids. The fastness to light, especially of the grey shades dyed with Immedial Black, is also excellent, while that of the Immedial Brown combinations may be considerably increased by an aftertreatment with sulphate of copper and bichrome.

The goods are aftertreated at 140—175° F. with:

1 % sulphate of copper
1 % bichrome of the weight of the goods
2 % acetic acid

for about ½ hour and finally rinsed.

Topping Diamine Colours and Immedial Colours with Basic Dyestuffs.

If the shades produced with Diamine or Immedial Colours are lacking in brilliancy, they are brightened by topping with basic dyestuffs.

This brightening may be applied for both direct and after-treated colours and can take place in any dyeing machine. A jigger or a padding machine is, however, generally used.

The bath, which must be rather diluted, is prepared with 2 % acetic acid or alum and the solution of the required basic dyestuff (added as usual in 2 or more portions). The dyeing is begun in the cold liquor, which after two passages is heated to about 105° F. and thoroughly exhausted in 4 passages. The goods are then rinsed in cold water.

With some kinds of goods the basic dyestuff required for topping may also be added direct to the finishing paste.

Dyeing with Basic Dyestuffs.

For piece-dyeing the basic dyestuffs enumerated on pages 152—163 are employed according to the instructions given on pages 145—150.

These instructions may be supplemented by the following particulars.

Mordanting with Tannin.

For this purpose a jigger or padding machine is in most cases employed.

When mordanting in the jigger, the bath is charged according to the shade to be dyed with 1—4 % tannin or 3—12 % sumac extract, the goods entered hot and worked for about 1—1½ hours. The mordanting bath need not be heated any further, the tannin exhausting better by the bath being allowed to cool down finally. The goods are cooled by being left lying for some hours, or they are simply passed through cold water and then treated with antimony to fix the tannin.

If the mordanting takes place in the padding machine, a solution of 6—20 oz tannin per 10 gallons of water or a corresponding quantity of sumac extract is used. The goods are given 2—4 ends, the first ones at 140—160° F. and the following ones in the cooling bath; they remain well covered up for a couple of hours until cooled off or they are passed, for better cooling, through cold water. The tannin mordant is afterwards fixed with some antimony salt.

Fixing with Salts of Antimony.

The fixing may be effected with tartar emetic, antimony salts or any other of the substitutes described in the appendix. It is carried out at the ordinary temperature in the jigger for $^1/_4$—$^1/_2$ hour or in the padding machine by 1—2 passages, about $^1/_3$ or $^1/_2$ the quantity of tannin being used as of tartar emetic, and of its various substitutes quantities corresponding to the amount of antimony they contain.

After fixing, the goods are thoroughly rinsed.

Fixing with Salts of Iron.

For dark dull shades, iron salts are sometimes employed for fixing in place of antimony salts, solutions of pyrolignite of iron of 1—2 % strength being used exactly as described for fixing with antimony salts.

Dyeing.

The dyeing is usually carried out in the jigger and only very rarely in the padding machine. The dye-liquor should be as dilute as possible, concentrated baths easily causing uneven dyeings.

The cold dye-bath is first charged with 2—4 % acetic acid or 3—5 % alum (for Naphtindone 3—4 % sulphate of alumina), then with part of the colour solution, and the goods are entered. During the second passage the remainder of the colour solution is added and the dyeing continued in the cold bath until it is fairly well exhausted. The bath is then slowly heated to 160° F. or to the boil, so as to better exhaust the colour and to fix it thoroughly and evenly, and finally the goods are well rinsed in cold water.

If the goods are not easy to penetrate, the colouring matter is added in 4 portions and the quantity of acetic acid doubled.

Dyeing with an addition of Tannin.

Pale shades are dyed direct in a bath prepared with tannin, the dyestuff and acetic acid.

The quantities required for example for pale blue are:

6—12 drams New Methylene Blue
2— 3 oz tannin
5— 8 ,, acetic acid
per 10 gallons of dye-liquor,

the dyeing being effected in a jigger or padding machine at 85° F. in 1 or 2 passages.

The colour is then fixed, without previous rinsing, in a cold bath containing antimony salts equal to about half the quantity of tannin employed.

Dyeing with Acid Dyestuffs.

These dyestuffs are chiefly used for dyeing very bright shades on cheap linings (drapery goods, book-cloth, glacés etc.).

The fastness of the dyeings to washing is rather poor, but the fastness to light of some of them, especially of the reds dyed with Brilliant Croceïne, is excellent.

For dyeing the colours on piece-goods the padding machine is employed exclusively.

Scarlets.

These dyestuffs are applied to piece-goods according to two methods, a) by direct dyeing, b) by dyeing on a mordant.

a) Direct Dyeing.

The padding machine is charged with a solution containing the requisite quantity of colouring matter and in addition,

$^1/_2$	lb	alum	per 10 gallons of liquor.
$^1/_2$	,,	Glauber's salt	
1	,,	dextrine	

The dry pieces are passed through twice at 140° F. and dried without previous rinsing.

All the colours enumerated on page 167 may be used, where will also be found an indication of the approximate quantities of dyestuffs required.

b) Dyeing mordanted Pieces.

This method offers the advantage over the preceding one of yielding deeper, fuller shades, which may, if required, be lightly rinsed after dyeing.

The pieces are mordanted in the padding machine by 2—4 passages through a solution of

$2^1/_2$—3 lbs stannate of soda per 10 gallons of liquor, and fixed with basic alum.

The solution of alum is prepared by neutralising

8—10 % alum (of the weight of the goods)

with 2—3 % soda crystals.

The goods pass 2—4 times through the cold solution of alum, also on the pad, and are then dyed on the pad in a fresh liquor at 140—160° F. without any other additions than the requisite quantity of colour.

The dye-liquors are not exhausted and may either be preserved or used for staining the finishing paste.

Eosines.

The various dyestuffs and the approximate quantities required are stated on page 169.

a) Direct Dyeing.

The goods are dyed in the padding machine in 2—4 passages through lukewarm liquor charged with the requisite quantity of colour and

3 lbs common salt and }
1 lb dextrine } per 10 gallons.

After dyeing, the goods are dried without rinsing.

b) Dyeing mordanted Pieces.

The goods are impregnated on the pad with a lukewarm 10% solution of Turkey-red oil, dried and further treated for fixing with basic acetate of alumina 4° Tw.

In each case the liquors are applied cold, and after the passage through acetate of alumina the goods are rinsed.

The dyeing is usually effected cold or at a temperature not exceeding 85—105° F., and the dye-bath is charged with the colouring matter only, without any other additions.

The goods are sometimes mordanted with Turkey-red oil only and then dyed; in this case 3 to 4 lbs common salt per 10 gallons of liquor should be added to the dye-bath.

Soluble Blues.

The colouring matters which may be used have been indicated on page 170.

a) Direct Dyeing.

The pieces are padded with alum and Glauber's salt as described for Scarlets.

b) Dyeing mordanted Pieces.

The pieces are mordanted with tannin and tartar emetic in the manner described on page 345 for basic dyestuffs and then dyed, the dye-bath receiving in addition to the requisite quantity of colour,

15—20 % alum (of the weight of the goods).

The shades dyed in this way are not quite so brilliant as those obtained by method a), but they resist a light washing, for which reason this method is generally preferred.

Dyeing with Paranitraniline C and Nitrazol C.

The pieces are impregnated with a solution of Beta-Naphtol and dried in a hot flue or a tentering frame. They are afterwards passed through the developing bath and then well washed and soaped. In the absence of a hot flue or tentering frame the pieces prepared with Beta-Naphtol may also be dried on drying cylinders, for which purpose, however, the first cylinders must be well wrapped with cotton cloth.

Preparing with Beta-Naphtol.

Impregnating of the pieces with a solution of Beta-Naphtol is best done in a padding machine.

The trough is filled with the solution of Beta-Naphtol, which is replaced, as it is taken up during the passage of the pieces, by a fresh solution of Beta-Naphtol.

The pieces should be developed as soon as possible after having been prepared with Beta-Naphtol and dried.

Not more of the Beta-Naphtol solution should be prepared at a time than is required for the day's consumption.

Beta-Naphtol Solution.

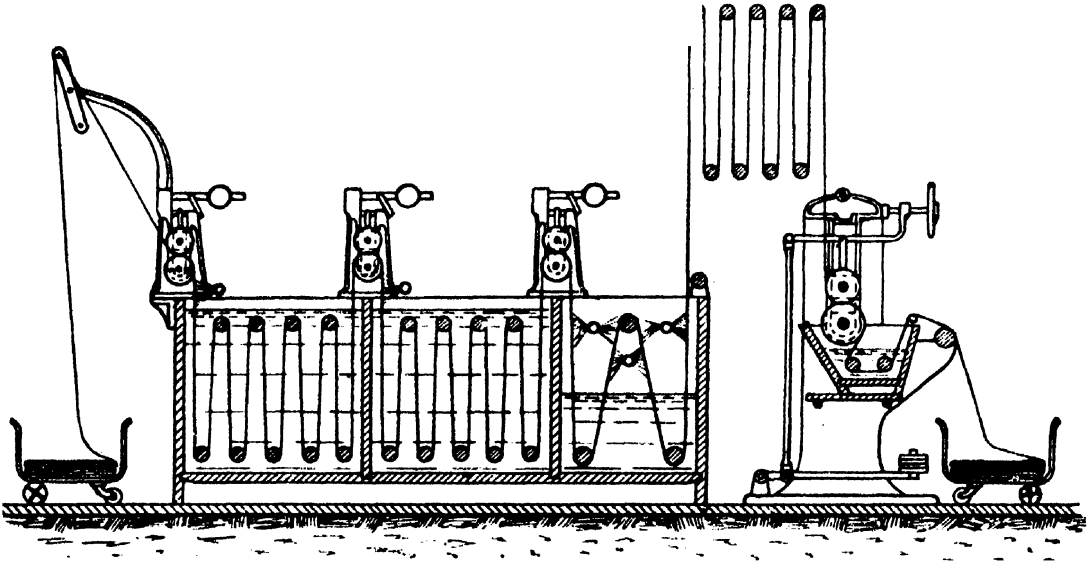
In a suitable vessel (barrel or bucket)

4 1/2	lbs	Beta-Naphtol and
6 1/2	oz	Red Developer C are mixed with
4 1/2	lbs	caustic soda lye 75° Tw;
7 1/2	„	boiling water and subsequently
6 1/2	„	cold water are added, then
10	„	castor oil soap*) dissolved in
50	„	hot water are added and the whole diluted with cold water to
20 gallons.		

If a more yellowish red is desired, the addition of Red Developer is omitted, without otherwise altering this recipe; see page 243.

Developing.

The developing of the dried pieces which have been prepared with Beta-Naphtol is effected in a padding machine similar to the sketch below.



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*) The preparation of castor oil soap has been described on page 244.

Both Paranitraniline C and Nitrazol C may be used for developing. The following description explains the method of working with either product.

Developing with Paranitraniline C.

In a bucket

Liquor A.		2 lbs 13 oz	Paranitraniline C are mixed with
		2 gallons	boiling water and perfectly dissolved by the addition of
		$4^{1}/_{2}$ pints	hydrochloric acid 36° Tw.*) This solution is stirred into
	about	5 gallons	cold water, whereby the hydrochloride of Paranitraniline separates in the shape of yellow flakes. Then
	about	10 lbs	ice are added for cooling, and after the temperature has fallen to about 50—57° F.,
		1 gallon $4^{1}/_{2}$ pints	solution of nitrite 1:10 are added. The clear solution obtained after a few minutes is diluted with cold water to
		15 gallons.	

In another vessel

Liquor B.	6 lbs	acetate of soda are dissolved in
	4 gallons	water and diluted with water to
	5 gallons.	

For developing,

3 parts of liquor A
1 part of liquor B

are used.

---

*) Paranitraniline C if mixed with boiling water is completely dissolved on the addition of hydrochloric acid without further heating being necessary. If the water is not hot enough, the Paranitraniline will not be entirely dissolved on the addition of hydrochloric acid, and the mixture has to be heated until complete solution results.

Developing with Nitrazol C pat.

Nitrazol C is a staple diazo-compound of Paranitraniline C and admits of simpler working, as it dispenses with the diazotising operation required for Paranitraniline C.

In a suitable vessel

Liquor A.	16 lbs	Nitrazol C are dissolved in
	5 gallons	water at the ordinary temperature, and this solution is made up with water to
	15 gallons.	

In another vessel

Liquor B.	2 lbs $3\frac{3}{4}$ oz	caustic soda lye 75° Tw. are diluted with
	2 gallons	water, mixed with
	6 lbs	acetate of soda dissolved in
	2 gallons	water and the solution made up with water to
	5 gallons.	

For developing,

3 parts of liquor A
1 part of liquor B

are used.

The trough of the machine is filled with developing liquor, the temperature of which should not exceed 57° F., and during the passage of the pieces, fresh diazo-solution (3 parts of A and 1 part of B) is added according to the quantity consumed.

After passing the developing liquor and the squeezers fixed at the end of the trough, the pieces are guided over wooden rollers a distance of a few yards through the air, so that the colour may have time to develop perfectly.

Finally, the pieces are sent through several washing boxes, soaped, and well rinsed.

The Dyeing of Mercerised Fabrics.

For dyeing mercerised fabrics, Diamine Colours are principally used. Very bright shades are dyed with Diamine Colours and topped with basic dyestuffs, or dyed with basic dyestuffs only.

The dyeing is usually effected in the open vessel or in the jigger, black being also dyed in the continue machine.

In order to counteract the tendency of mercerised goods to absorb the colours too rapidly, the temperature is kept very low at the beginning of the dyeing operation, and considerably less Glauber's salt is used than with ordinary goods.

It is generally computed that 20—25 % less dyestuff is used for mercerised goods than for unmercerised fabrics.

Dyeing with Diamine Colours.

The jigger is charged

for pale shades with:

3 % soda ash 1 % Turkey-red oil or soap	of the weight of the goods

and the requisite quantity of colouring matter.

The dyeing commences at about 105° F., and after two passages the temperature is raised to about 140° F.

Medium and dark shades are dyed with the addition of

3 oz soda ash 1 1/2 oz Turkey-red oil 1—1 1/2 lb cryst. Glauber's salt	per 10 gallons of liquor.

The dyeing begins at about 120° F., and the Glauber's salt, divided into two portions, is only added after the fourth passage; the temperature is then raised to 175° F. and finally two ends are given at the boil.

The dyeing in the open vessel or in the continue machine is the same as described on pages 314 and 318, with the only difference that the quantities of Glauber's salt stated there are reduced by about one half.

Diazotising and developing, aftertreatment with metallic salts etc. are the same with mercerised as with unmercerised goods; the chemicals to be employed must, however, be reduced by about 20 per cent.

Dyeing with Basic Dyestuffs.

The charges for the mordanting baths described on page 345 are reduced by about one third.

The dyeing proper requires some attention if levelness and good penetration are the ultimate objects. The dye-bath should therefore be rather diluted and charged with 3—4% acetic acid, and the colour solution should be added in 3 or 4 portions. The dyeing should commence cold and the bath only be heated when fairly well exhausted.

Very light shades are dyed in a lukewarm soap bath.

Dyeing with Immedial Colours.

For dyeing with Immedial Colours on mercerised goods, the quantity of sodium sulphide must be somewhat increased and that of salt considerably reduced.

Immedial Black especially is very extensively employed on mercerised goods, as it yields exceedingly fine and rich shades of very good fastness to rubbing, the lustre of the goods not being at all impaired by the dyeing operation.

The process offers the additional advantage that the goods need not be soured off after mercerising, but may be dyed directly after rinsing. The goods must not however carry too great an excess of caustic lye, as the bath would thereby be rendered too alkaline.

For dyeing with Immedial Black, the jigger is charged with

$^1/_2$ lb. soda ash
$2\,^1/_2$—3 lbs. Immedial Black
$2\,^1/_2$—3 „ cryst. sodium sulphide
1 lb.—1 lb. 3 oz. dextrine
5—8 oz common salt

per 10 gallons of liquor,

in addition to the following percentages calculated on the weight of the goods to be dyed;

8—9 % Immedial Black
8—9 % cryst. sodium sulphide.

Subsequent lots should be dyed with:

8—9 % Immedial Black
8—9 % cryst. sodium sulphide
2 % dextrine
1 % soda ash.

of the weight of the goods.

After dyeing, the goods are well squeezed off and at once thoroughly rinsed. If this be done in a full width washing machine, the first tank may with advantage be charged with a little sodium sulphide (about 5 oz per 10 gallons).

The aftertreatment is the same as described for unmercerised goods on page 332.

Very closely woven fabrics which are difficult to dye through may with advantage be passed before dyeing through a bath of Turkey-red oil (6—8 oz per 10 gallons) and taken from there straight into the dye-bath.

Dyestuffs yielding Shades fast to Storing.

The alteration in shade, which has been observed in isolated cases when mercerised or other soft-finished goods were stored in damp warehouses, is probably due in the first instance to the absorption of moisture, but the right selection of the dyestuffs employed is undoubtedly also very important.

We have carefully tested our colouring matters in this direction and have found the following to be the most suitable:

Diamine Colours:

- Thioflavine S
- Diamine Fast Yellow A
- Diamine Fast Yellow B
- Diamine Fast Yellow FF
- Diamine Yellow CP
- Diamine Orange G
- Diamine Orange D
- Diamine Catechine B
- Diamine Brown M
- Diamine Brown R in medium and dark shades
- Diamineral Brown G in medium and dark shades
- Diamine Rose all brands
- Diamine Brilliant Scarlet S
- Diamine Red 4 B rinsed with alkali
- Diamine Bordeaux S
- Diamine Bordeaux B rinsed with alkali
- Oxy Diamine Violet B
- Oxy Diamine Violet G
- Diamine Blue BX, 2 B, 3 B
- Diamine Blue RW
- Diamine Sky Blue
- Diamine Sky Blue FF
- Diamine Azo Blue R and RR
- Diamine Blue NC
- Diamine Steel Blue L
- Diamine Fast Blue C
- Diamine Fast Blue CG
- Diamineral Blue R
- Diaminogene Blue } all brands developed with Beta-Naphtol
- Diamine Azo Blue }
- Diamine Green B
- Diamine Green G
- Diamine Dark Green N
- Diamine Grey G
- Diamine Dark Blue B
- Diamine Black HW

Oxy Diamine Black Diamine Jet Black Diamineral Black	all brands in medium and dark shades
Diamine Black BH Diaminogene all brands	developed with Beta-Naphtol or Phenylene Diamine

Basic Dyestuffs.

Thioflavine T
Tannin Orange
Safranine all brands
Irisamine G
Tannin Heliotrope
New Methylene Blue N, R, GG
Methylindone B, R
Naphtindone BB
Metaphenylene Blue all brands
New Blue all brands
Indazine M
Brilliant Green
Solid Green.

Immedial Colours.

An alteration of shade has not yet been observed with any product belonging to the series of Immedial Colours.

The Dyeing of Cotton Pieces with Woollen or Silk Shots.

For dyeing cotton goods with shot effects, only those Diamine Colours are used which stain the animal the fibres least.

Best adapted are:

For yellow and orange shades:

Thioflavine S, Diamine Fast Yellow A, AR, FF, Diamine Orange G and D.

For pink and red shades:

Diamine Rose, all brands, Diamine Brilliant Scarlet S, Diamine Red 4 B and 10 B.

For violet shades:

Diamine Violet Red, Diamine Heliotrope G, O and B, Oxy Diamine Violet B and R.

For brown and mode shades:

Combinations of Diamine Orange D, Diamine Fast Yellow A, Diamine Red 4 B, Diamine Nitrazol Brown G, Diamine Black BH.

For olive and green shades:

Combinations of Diamine Sky Blue FF, Diamine Sky Blue, Diamine Blue 2 B, 3 B, Diamine Black BH, Diamine Fast Yellow A, FF, Thioflavine S, Diamine Orange G and D.

For blue shades:

Diamine Sky Blue FF, Diamine Blue 2 B, 3 B, Diamine Blue NC, Diamine Brilliant Blue G, Diamine Black BH, Diamineral Blue R, Diamine Fast Blue C, CG, Diamine Dark Blue B.

For grey shades:

Diamine Grey, Diamine Black BH shaded with Diamine Fast Yellow A, or Diamine Orange G and D.

For Black:

a) Diamine Black BH
shaded with some
Diamine Fast Yellow A
} diazotised and developed with Phenylene Diamine and Beta-Naphtol, or Phenylene Diamine and Resorcine.

b) The combination of Diamine Black 31 with Aniline Black described on page 175.

The dye-bath is prepared with
8 oz soap
6½—13 ,, cryst. Glauber's salt
} per 10 gallons of liquor,
and the goods are dyed in ½—¾ hour at about 85—95° F.

The diazotising and developing baths for diazotised Blacks should be ⅓ weaker than otherwise usual, and both operations must be executed as rapidly as possible in order to preserve the purity of the white wool or silk.

Cotton goods with silk shots may also be dyed with Immedial Colours by addition of glue according to a process protected to us by patent. Staining of the silk is avoided by such an addition and by dyeing at a moderate temperature.

Black, for instance, is dyed according to this method with
1 —2 lbs Immedial Black
1 —2 ,, sodium sulphide
1½—3 ,, glue
½ lb soda
2 —3 lbs salt
} per 10 gallons of liquor at 85—105° F. for ½—¾ hour.

The silk may then be cross-dyed at will with acid dyestuffs.

In the same way Browns and Blues and all kinds of mode shades may be produced with Immedial Colours.

Mercerised goods with woollen or silk shots are dyed in the same way and yield considerably brighter effects than unmercerised goods.

The Production of Standard Shades on Piece-Goods.

Grey.

For cheap Greys are used:

a) the various brands of Oxy Diamine Black dyed in light shades.

The fastness to light and hot pressing of the various groups is indicated in the tables on pages 56—61.

b) the various brands of Diamine Jet Black dyed in light shades.

The colours are superior in fastness to light to those named sub a) and are therefore especially used for moleskins, velveteens and prints.

For grey shades which can only be obtained by a combination of several dyestuffs, the following easily levelling colours are used:

Diamine Dark Blue B
Diamine Black BH
Diaminogene extra
Diaminogene B
Diamine Grey G
Diamine Catechine B
Diamine Brilliant Scarlet S
Diamine Orange D
Diamine Orange G
Diamine Fast Yellow B.

These dyestuffs are likewise preferred for dyeing grey shades on mercerised goods.

Greys of excellent fastness to light and washing are obtained with:

Diamine Fast Blue C or CG
Diamine Fast Yellow B or FF
Diamineral Brown G
Diamine Dark Blue B
Diamine Blue RW
Diamine Fast Yellow B
Diamine Orange B
aftertreated with sulphate of copper

and also with the various brands of

Immedial Black
shaded if required with
Immedial Brown etc.

The dyeings produced in this way satisfy the most exacting claims and are used for the best class of dress-goods, velveteens, upholstery and decorative goods.

Creams.

The most serviceable colours for these shades are:

Diamine Fast Yellow A, B, FF or Diamine Yellow CP, which are very fast when applied direct without any aftertreatment.

For shading to the red side Diamine Orange G or D are used.

For shading towards greenish yellow:
Thioflavine S.

Creams are also frequently dyed by padding on the pad with Diamine Fast Yellow FF or Diamine Orange G or D.

Yellow.

The brightest shades are dyed with:

Thioflavine S
Diamine Yellow CP
Diamine Fast Yellow A.

Yellow shades fast to light, such as for bunting, are produced with:

Diamine Fast Yellow B or FF
or, in isolated cases, with:
Thioflavine T on tannin and antimony.

Orange.

For direct orange shades are recommended:

Oxy Diamine Orange G and R
or Diamine Brilliant Scarlet S shaded with Diamine Yellow CP.

Dyeings of greater fastness to light are obtained with:

Diamine Orange G and D
and also with
Diamine Orange B aftertreated with sulphate of copper.

For mercerised goods principally Diamine Orange G and D, and also the combination of Diamine Brilliant Scarlet S with Diamine Yellow CP, are employed.

Mode and Olive Shades.

a) Combinations of the following dyestuffs are used for light shades:

Diamine Catechine B and 3G
Diamine Brown R
Diamine Brilliant Scarlet S
Diamine Orange D or G
Diamine Fast Yellow B or FF
Diamine Dark Blue B
Diamine Black BH
Diaminogene extra and B
Diamine Fast Blue C and CG
and the various brands of
Diamine Blue.

Pale mode shades on mercerised goods are also dyed with these colours.

b) Heavier mode and olive shades are dyed with

Diamine Bronze G
Diamine Green B and G
Diamine Black HW
Diamine Catechine G
Diamine Brown M
Diamine Brown 3 G
Diamineral Blue R

shaded, if required, with the colours named under a) or with Oxy Diamine Black.

For mercerised goods, not the dyestuffs of this group, but those named under a), are used.

c) For olive and mode shades of special fastness to light:

Diamine Orange D
Diamineral Brown G
Diamine Fast Yellow B or FF
Diamine Fast Blue C or CG
or
Diamine Blue RW
Diamineral Blue R
Diamineral Brown G
Diamine Catechine B
Diamine Catechine 3 G
Diamine Orange B
Diamine Fast Yellow B

aftertreated with sulphate of copper.

d) Dark olive and mode shades for moleskins and velvets in particular are dyed cheaply and fast to washing with:

Diamine Nitrazol Brown G
Primuline
Diamine Bronze G
Diamine Blue NC

coupled with Nitrazol.

e) A great number of very fast mode shades, including the various khaki shades, are produced with:

Immedial Brown B, G
Immedial Dark Brown A
Immedial Bronze A
Immedial Black

to be aftertreated with sulphate of copper and bichrome if very exacting claims in respect to fastness to light are made. See page 344.

Brown.

The cheapest Browns are obtained with:

Cotton Brown A, N
Oxy Diamine Brown G
Diamine Nitrazol Brown RD, BD and T
  shaded, if required, with
    Oxy Diamine Orange G and R
    Diamine Fast Yellow B
    Oxy Diamine Blue G
      or with
    Oxy Diamine Black A.

Brown shades of superior fastness to light on moleskins, velveteens and upholstery cloth are dyed with:

Diamine Brown M and R
Diamine Catechine B and G
Diamineral Brown G
  shaded with
    Diamine Fast Yellow B
    Diamine Orange D, G
    Diamine Dark Blue B
    Diamineral Blue R
      and also:
Diamine Cutch developed with Fast Blue Developer AD.

Brown shades of very good fastness to light are obtained with:

Diamine Brown 3 G
Diamine Orange B
Diamine Catechine B
Diamine Catechine 3 G
Diamineral Brown G
Diamine Fast Yellow B
Diamine Dark Blue B
Diamineral Blue R

aftertreated with sulphate of copper.

For cheap dark Browns, very fast to washing, on moleskins, velveteens and dress goods, are used:

Diamine Nitrazol Brown G
Diamine Nitrazol Brown RD
Diamine Nitrazol Brown B
Diamine Nitrazol Brown BD
Diamine Nitrazol Brown T
Diamine Brown S

after dyeing coupled with Nitrazol,

and shaded, if required, with:

Diamine Jet Black OO
Primuline.

Other Browns exceedingly fast to light and washing are also obtained with:

Immedial Brown B and G
Immedial Dark Brown A

dyed direct, or aftertreated with bichrome and sulphate of copper,

and shaded, if required, with:

Immedial Black
or with
Diamine Fast Yellow B and FF.

To produce specially brilliant shades the above named combinations are frequently topped with basic dyestuffs.

Blue.

For direct shades, which in light tones may also be obtained by padding, are used:

Diamine Sky Blue FF
Diamine Sky Blue
Diamine Blue RW, BG, BX, 2B, 3B
Diamine Brilliant Blue G
Diamine Blue C4B
shaded, if required, with
the other blue Diamine Colours.

For Navy Blues are employed:

Diamine Blue BX
Diamine Blue 3B
Diamineral Blue R
Diamine Deep Blue R
Diamine Azo Blue R and RR
Oxy Diamine Blue G and R
shaded, if required, with
Diamine Black BH,
or with
Oxy Diamine Black,
or
topped with basic dyestuffs if greater brilliancy be desired.

For twills, moleskins and other cheap suitings Diamineral Blue R and Diamine Deep Blue R especially are extensively used, either dyed direct or topped with Naphtindone.

For shades very fast to light:

Diamine Fast Blue C Diamine Fast Blue CG	dyed direct

or

Diamine Sky Blue FF
Diamine Blue RW, 3R
Diamineral Blue R
Diamine Brilliant Blue G
Diamine Dark Blue B

aftertreated with sulphate of copper.

Cheap dark Blues fast to washing, especially for dress-goods, moleskins, velveteens etc. are dyed with:

Diamine Black BH
Diamine Azo Blue R and RR
Diamine Azo Blue 6 B

developed with Beta-Naphtol or Naphtylamine Ether N.

Dyeings fast to light and washing available for better class goods generally, and particularly as substitutes for Indigo, are produced with:

Diaminogene Blue BB
Diaminogene Dark Blue
shaded with
Diamine Azo Blue

developed with Beta-Naphtol.

Immedial Blue C or CR steamed
Immedial Direct Blue topped with basic dyestuffs, if required,
Immedial Sky Blue aftertreated with sulphate of copper and bichrome.

Bright Blues very fast to light and washing are dyed with:

New Methylene Blue, all brands, on a mordant of tannin and antimony,

and darker shades with

Indazine
Naphtindone
Methylindone

on a mordant of tannin and antimony.

Very brilliant Blues not possessing special fastness, with:

Soluble Blue, all brands, (see page 170) on a mordant of tannin and antimony.

For mercerised goods all the above named dyestuffs are used in the same way.

Pink.

Pink shades, which may also be produced by padding, are dyed direct with:

Diamine Rose BD, BG, GD, B extra
shaded, if required, with:
Diamine Brilliant Scarlet S
or with
Diamine Fast Yellow A
Diamine Orange D.

Dyeings of especial brightness:

Irisamine G
Safranine } on a mordant of tannin and antimony.

Brilliant shades not resistant to washing:

Eosines, Brilliant Croceïnes (see pages 167—169).

Red.

Direct Dyeings.

Diamine Scarlet 3B
Diamine Red 4B, 5B, 6B, 10B, D
Diamine Fast Red F.

Dyeings fast to acids:

Diamine Scarlet 3B
Diamine Fast Red F
†Diamine Brilliant Scarlet S
†Paranitraniline Red.

The shades of the colours marked with a cross † are not materially influenced even by mineral acids.

Reds of good fastness to washing:

a) Diamine Fast Red F aftertreated with chromium fluoride.
b) Irisamine } on a mordant of tannin and antimony.
Safranine }
c) Paranitraniline Red.

Very brilliant Reds of very good fastness to light but not fast to washing:

All brands of Brilliant Croceïne and Scarlet (see page 167).

For mercerised goods the same combinations are employed.

Claret.

For direct dyeings:

Diamine Bordeaux B, S
Diamine Fast Red F
Diamine Red 10 B
shaded with
Oxy Diamine Violet B, G, R
Diamine Violet N
Diamine Brown M
topped, if required, with basic dyestuffs.

For dyeings especially fast to washing:

Tannin Heliotrope } on a mordant of tannin
Safranine } and antimony.

Violet and Heliotrope Shades.

Direct dyeings are produced with:

Diamine Heliotrope B, O, G
Oxy Diamine Violet B, G, R
Diamine Violet N
Diamine Blue 3 R
topped, if required, with basic dyestuffs.

Purples fast to washing are dyed with:

Diamine Azo Blue R, RR, developed with Naphtylamine Ether N

Methyl Violet Tannin Heliotrope New Methylene Blue R, 3R	on a mordant of tannin and antimony.

Green.

Direct dyeings:

Diamine Green B, G
Diamine Dark Green N
shaded, if required, with
Diamine Black HW.

The various Diamine Blues
shaded with
Diamine Fast Yellow B, FF or A
Thioflavine S
Oxy Diamine Yellow GG
shaded according to requirement with basic dyestuffs.

Greens fast to light:

Diamine Sky Blue FF Diamine Blue RW Diamineral Blue R Diamine Fast Yellow B, FF	aftertreated with sulphate of copper.

This combination is frequently used for dyeing twills and window drapings fast to light.

Dyeings fast to washing:

Diamine Green G aftertreated with chromium fluoride

New Methylene Blue Thioflavine T	on a mordant of tannin and antimony
Malachite Green Brilliant Green	on a mordant of tannin and antimony.

Black.

A cheap direct Black is dyed on any kind of ordinary goods with:

Oxy Diamine Black A
Oxy Diamine Black D
Oxy Diamine Black AT
Oxy Diamine Black AM
Oxy Diamine Black AFF
Oxy Diamine Black FFC
Oxy Diamine Black JEI
Oxy Diamine Black JW
Oxy Diamine Black JB.

Cheap Black of better fastness to light with:

Oxy Diamine Black NF
Oxy Diamine Black BG
Oxy Diamine Black W
Oxy Diamine Black B
Oxy Diamine Black BZ
Oxy Diamine Black SOOO.

These dyestuffs are also used extensively for dyeing velveteens.

Amongst the direct Blacks the following colours possess the best fastness to light:

a) Diamine Jet Black Cr
Diamine Jet Black RB
Diamine Jet Black SS
Diamine Jet Black OO
Diamine Dark Blue B.

b) Diamineral Black B
Diamineral Black 3B
Diamineral Black 6B

} aftertreated with bichrome and sulphate of copper.

These colouring matters are generally used for better class goods and especially for mercerised fabrics. The direct Blacks most frequently employed for mercerised fabrics are:

Diamine Jet Black Cr
Diamine Jet Black M
Diamineral Black 3B.

Cheap Blacks fast to washing, used particularly for men's suitings, moleskins etc., are:

Diamine Black BH	developed with Phenylene Diamine, or with Phenylene Diamine and Resorcine
Diamine Nitrazol Black B or Oxy Diamine Black A or D	coupled with Nitrazol with the addition of New Methylene Blue.

Blacks fast to light and washing employed especially as substitutes for Aniline Black:

Diaminogene B alone or shaded with Diaminogene extra	developed with Phenylene Diamine, or Phenylene Diamine and Resorcine, or Phenylene Diamine and Beta-Naphtol.

Immedial Black all brands.

Both Diaminogene and Immedial Black are employed most extensively for mercerised goods also.

V.

A. The Dyeing of Linen Yarns, Linen and Half-Linen Goods.

B. The Dyeing of China-Grass.

C. The Dyeing of Jute and Cocoa-Nut Fibre.

The Dyeing of Linen Yarns, Linen and Half-Linen Goods.

As is the case with cotton, previous boiling off or bleaching is necessary to prepare the goods for dyeing. For dark shades, boiling with 5—10% soda ash is sufficient, whilst for pale as well as brilliant shades the goods should be half bleached beforehand.

The dyestuffs recommended for cotton yarns and cotton pieces are likewise suitable for dyeing linen and half-linen goods; attention is, however, called to the fact that linen fibre is harder and therefore not quite so easily penetrated as cotton. The exhaustion of the colours should therefore be retarded as much as possible.

With Diamine Colours this is effected either by omitting the addition of salt or Glauber's salt or at least decreasing their quantity, or by slightly increasing the quantity of soda, or by adding soap or Turkey-red oil to the dye-liquor.

With basic dyestuffs a good penetration is attained by slightly mordanting with tannin in a rather hot bath, to which a little acid is added, and by the addition of acetic acid or alum to the dye-bath.

With Immedial Colours both a smaller quantity of salt, as is the case with Diamine Colours, and an increase of sodium sulphide as well as an addition of Turkey-red oil, is recommended.

The combinations given on pages 272—282 and on pages 362—374 for producing standard shades on cotton are also recommended for dyeing linen. The following notes will supplement those instructions.

Grey, cream, yellow, orange, mode and olive shades are chiefly dyed with Diamine Colours possessing satisfactory fastness to light. In many cases, particularly for mode and olive shades, the dyeings are aftertreated with sulphate of copper, when the combinations mentioned on page 275 should be employed.

Immedial Colours are also frequently used for dyeing mode, olive and khaki shades. The methods of dyeing will be found on pages 239 and 343 respectively.

For brown shades Diamine Browns of good fastness to light are chiefly used, and if very good fastness to light is essential, the dyeings are aftertreated with bichrome and sulphate of copper. In addition to these colours the various brands of Immedial Brown have recently come into prominent use.

For direct Blues the various brands of Diamine Blue are used. The Diamine Blues, aftertreated with sulphate of copper, which are named on pages 72—75, are also very extensively employed for this purpose.

Goods for dresses and aprons of linen and half-linen are also frequently dyed with a bottom of Diamineral Blue and topped with Naphtindone. In order to fix the Diamineral Blue, a little sulphate of copper may be added to the Naphtindone bath. These goods are dyed exceedingly fast with Immedial Blue C or CR or Immedial Direct Blue in place of Indigo (see pages 335, 338 and 340); such dyeings may be topped according to shade with basic dyestuffs or also in the Indigo vat.

For Pinks, Reds, Clarets and Greens the same dyestuffs are used as for cotton.

Blacks. For producing cheap Blacks the JEI, JW and JB brands of Oxy Diamine Black are principally employed.

If a better fastness to light is required, the various brands of Diamine Jet Black, and also Diamineral Black aftertreated with bichrome and sulphate of copper, are employed.

Blacks very fast to light and washing are dyed in some cases with Diaminogene and developed with Phenylene Diamine and Resorcine. Recently, however, Immedial Black has become the most important dyestuff for this purpose; it is dyed in the same way as described for cotton on pages 230 and 330, only that the quantity of colour is reduced by about $^1/_8$ th and that of Glauber's salt by one half.

The Dyeing of China-Grass.

China-grass resembles linen in its behaviour in dyeing, and the instructions given in the preceding pages for linen are therefore applicable for China-grass also. The material employed, being as a rule pure white and therefore not needing any bleaching, requires merely a boiling in a weak soda solution before dyeing.

The Dyeing of Jute.

Jute is usually dyed in the raw state, being merely wetted previously in boiling water.

If it is to be bleached for light shades, the bleaching is effected either with a solution of chloride of soda, subsequently treating with acids and sodium bisulphite, or by means of potassium permanganate and sulphurous acid (bisulphite mixed with sulphuric or hydrochloric acid). Care must be taken never to bleach jute too severely and always to rinse very thoroughly after bleaching.

Diamine Colours, basic dyestuffs and in some cases also acid dyestuffs are used for dyeing. Immedial Colours are rarely employed and only when the demands with regard to fastness are very high.

The Diamine Colours are dyed according to the instructions given for cotton and are chiefly used for producing shades fast to water and washing. They penetrate the fibre well and yield colours perfectly fast to rubbing. They find general application for pale mode shades, Olives and Browns, especially in place of the less easily levelling basic dyestuffs.

Oxy Diamine Black, particularly the JEI, JW and JB brands, is also used for cheap Blacks fast to rubbing.

For the production of all other shades the instructions given on pages 272—282 may be followed.

Basic dyestuffs, contrary to when dyed on cotton, require no mordant. Jute possesses such a remarkable affinity to basic colours that, to prevent flushing on, an addition of acetic acid or alum is absolutely necessary in dyeing material which is hard to penetrate. The wetted fibre is first turned for some time in a tepid bath charged with about 5 % acetic acid or alum (of the weight of the material); the dyestuff is then added in several portions and the bath heated to 175—195 ° F., gentle boiling being sometimes advisable.

All the basic dyestuffs enumerated on pages 152—163 are employed for jute, and for Blacks also the brands Jute Black 8174, 09624 and GN.

The acid dyestuffs named on pages 167—170 are also recommended for jute, especially the various brands of Brilliant Croceïne for yellowish red, scarlet and bluish red shades. In addition to these dyestuffs, the following are suitable for jute dyeing: Indian Yellow G and R, Orange extra and GG, Roccelline, Solid Blue R, 3 R, 6 G, Induline B, 2 B, 3 B, Nigrosine soluble in water and Aniline Grey. These colouring matters are dyed at the boil with the addition of 2—3 % alum or 3—5 % acetic acid. The acid dyestuffs dye level and are frequently employed for jute on account of their rather good fastness to light.

The Dyeing of Cocoa-Nut Fibre.

The same dyestuffs and methods of dyeing as for jute are recommended for this material.

Appendix.

The Weighting of Cotton.

The Brightening of Dyeings.

Methods of Discharging Diamine Colours.

The Application of Acetate of Soda for Unions.

The Stripping of Dyeings with Hydrosulphite.

Water and Important Chemicals.

Weights and Measures.

Hydrometer and Thermometer Tables.

The Weighting of Cotton.

As a rule the weight of cotton is not affected when dyed with Diamine Colours, whilst Immedial Colours effect a small increase in weight, amounting, in the case of Blacks, to about 3—5 %.

Basic dyestuffs on a bottom of tannin and antimony yield a charge of 2—5 % according to the quantity of mordant employed.

Artificial charging is usually effected in the finish, mineral filling material being added to the finishing paste. Loose cotton and cotton hanks, however, are sometimes aftertreated for this purpose with metallic salts.

The following metallic salts are employed for weighting cotton goods:

Magnesium sulphate (Epsom salts)
Zinc sulphate
Barium chloride
Calcium chloride,

the increase in weight amounting to about 8—12 %, if solutions of 8—10 lbs of these substances per 10 gallons of water are used.

The following liquor is frequently used for weighting:

For 100 lbs of cotton:

160 gallons water
80—120 lbs magnesium sulphate
16 ,, dextrine
{ 4 ,, rape-seed oil saponified with
{ 1 ,, soda.

The cotton is turned for a few minutes in the lukewarm bath, hydro-extracted and dried.

Sometimes the rape-seed oil is substituted by a little glycerine.

Black yarns are frequently weighted with sumac and iron.

The yarns are first immersed for a couple of hours in a bath of

15—20% sumac extract and, after wringing well, are
passed through a bath of
pyrolignite of iron of 3—5° Tw.

The increase of weight thus resulting amounts to 7 or 8 per cent.

The Brightening of Dyeings.

Pieces and yarns, which are not finished in the usual sense, are frequently brightened, principally with the object of enhancing the brilliancy of the shade.

a) Brightening with Soap.

Soap has the effect of enlivening the shades and is applied especially in the case of knitting and hosiery yarns.

A cold or lukewarm bath is prepared with water free from lime if possible, to which are added per 10 gallons:

3/4 oz soda 3 oz soap	previously dissolved in hot water.

The cotton is worked for a few minutes, hydro-extracted and dried without rinsing.

Piece-goods are treated in the same way, but are well rinsed after soaping.

b) Brightening with Turkey-red Oil and Soda.

The bath is prepared approximately with:

1 1/2 oz soda 4 1/2 oz Turkey-red oil	per 10 gallons of liquor

and used exactly as described above for the soap bath.

This method is chiefly used for shades dyed with colours sensitive to acids in order to improve their fastness.

If the peculiar smell of Turkey-red oil should be objectionable, soap may be substituted.

c) Brightening with an Emulsion of Oil and Soap.

A boiling solution is prepared of
4 lbs soap in
10 gallons water;
2 lbs olive oil are stirred in, and the emulsion is then added to 100 gallons of cold water. In this bath the cotton is worked for a few minutes, hydro-extracted or wrung off, and dried.

Similar results are obtained with
3 lbs olive oil soap
1 ,, olive oil } boiled together
4 gallons water
and added to 80 gallons of cold water.

The baths are used cold or lukewarm, yarn being turned 5 times, lifted and dried, and pieces only passed once through the liquor and dried.

Dyeings of Immedial Black*) may be brightened with the following emulsion for 100 lbs of cotton:

4 lbs olive oil soap
2½ ,, olive oil
1 lb ammonia liquor } boiled together.
10 oz acetate of soda

The emulsion is used as described above, the liquor however being heated to 115—120° F.

d) Brightening with an Emulsion of Oil and Soda.

The yarn is worked for about ¼ hour in a lukewarm bath, prepared, according to the desired feel and the quantity of material, with:
½—2 % olive oil } boiled separately with water;
¼—½ % soda ash
after lifting, the yarn is hydro-extracted and dried.

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*) The method of brightening with starch and fat most frequently used for Immedial Black is given on page 231.

The Production of a Silky Scroop on Cotton Yarns.

A. Dyeings on bleached yarn.

The dyed and hydro-extracted yarn is turned a few times in a cold bath containing

8 % soap of the weight of the material,
hydro-extracted and entered into another bath containing

½—1 lb acetic acid 30 %
½—1 „ acetate of soda
per 10 gallons,

or, if a specially permanent scroop be desired,

3— 5 oz tartaric acid
8—16 „ acetate of soda
per 10 gallons.

The yarn is worked in this bath for 10 minutes and dried without any previous rinsing.

B. Dyeings on unbleached yarn.

The above process gives good results on unbleached yarns also, if they are boiled before dyeing with about 5 % soap and 5 % soda.

If this boiling cannot be done conveniently, the following method is used:

The dyed and hydro-extracted yarn is treated for about 20 minutes at 85—105° F. in a bath prepared with:

1½ % starch
1½ % cocoa-nut oil
½ % tannin
of the weight of the yarn.

The starch is mixed as usual with water, boiled together with cocoa-nut oil and added to the bath through a sieve, whilst the tannin is dissolved by itself and added to the bath. After sufficient turning the yarn is hydro-extracted and soaped in a lukewarm bath with the addition of:

7—8 % olive oil soap } of the weight
1 % starch } of the yarn.

The yarn is again hydro-extracted and entered into a third (cold) bath, containing

5 oz tartaric acid } per 10 gallons,
1 lb acetate of soda }

worked for about 10 minutes and dried without previous rinsing.

Staining the Finishing Paste with Logwood.

For black linings, glacés, and similar calandered goods with a stiff finish, the finishing paste is frequently stained with logwood.

For 100 gallons of finishing paste the following approximate quantities may be used:

1 gallon logwood extract 52° Tw.
1 pint fustic extract 52° Tw.
$^2/_3$,, pyrolignite of iron 77° Tw.
6 oz bichrome.

Methods of Discharging Diamine Colours.

Most of the Diamine Colours are easily discharged white or coloured by means of reducing agents. Tin crystals or zinc dust and bisulphite are chiefly used for this purpose.

The Tin Crystals Discharges most frequently used are:

A. For short steaming:

(For goods to be steamed after printing in the small Mather-Platt ager.)

I. Normal Tin Crystals Discharge.

12 oz wheat starch
35 ,, acetate of tin 28° Tw. are boiled together;
16 ,, dextrine
2 ,, citric acid
before becoming quite cold
18 ,, tin crystals are added
and after cooling
4—5 ,, acetate of soda.

II. Discharge with Tin Crystals and Acetate of Soda.

This discharge acts similarly to No. I, but is more easily prepared, the acetate of tin being omitted.

18 oz wheat starch
37 ,, water
15 ,, dextrine
3 ,, citric acid
are boiled together;
before becoming quite cold
22 ,, tin crystals
and after cooling
5—7 ,, acetate of soda are added.

Discharges I and II are mixed with 3 oz of a 2 per cent solution of Alkaline Blue in order to tint the white slightly.

III. Discharge with Ferrocyanide of Tin.

This discharge is somewhat more expensive than I and II, but produces a brighter and more bluish white.

3	oz	wheat starch	are boiled together;
$23^{1}/_{2}$	,,	water	
10	,,	white dextrine	
3	,,	citric acid	
		whilst still warm	
22	,,	tin crystals are added;	
		after cooling, the whole is well mixed with:	
11	,,	ferrocyanide of potash	dissolved and stirred until cold.
$7^{1}/_{2}$	,,	water	
20	,,	gum solution 1 : 1	

IV. Discharge with Sulphocyanide of Tin.

6	oz	wheat starch	boiled together;
6	,,	British gum	
18	,,	water	
10	,,	acetine	
25	,,	tin crystals	
6	,,	citrate of ammonia 36° Tw.*	
6	,,	acetate of soda	
5	,,	barium sulphocyanide.	

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* Citrate of ammonia:
Citric acid is neutralised with ammonia and the solution diluted to 36° Tw.

V. Alkaline Tin-Discharge.

This discharge is only used if pigment colours are to be added to the discharge paste.

6	oz	wheat starch	are boiled together;
6	,,	water	
16	,,	dextrine	
36	,,	stannous hydrate in paste	
		when cool, a mixture of	
11		ammonium chloride	
15		tartrate of ammonia†)	
12		gum tragacanth 65:1000	
		is added.	

B. Discharges for prolonged steaming.

The following discharges serve for styles requiring prolonged steaming (${}^1/_2$—${}^3/_4$ hour).

I. Discharge with Acetate of Tin.

$12\,{}^1/_2$	oz	wheat starch	are boiled together.
$70\,{}^1/_2$	,,	acetate of tin 28° Tw.	
21	,,	white dextrine	
4	,,	citric acid	

II. Discharge with Tin Crystals and Acetate of Soda.

This discharge is very similar in its effect to the preceding discharge (No. I).

8	oz	wheat starch	are boiled together;
4	,,	white dextrine	
25	,,	acetic acid	
4	,,	citric acid	
		to the warm mixture	
27	,,	tin crystals and after cooling	
33	,,	acetate of soda are added.	

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†) Tartrate of ammonia: 1 lb of tartaric acid is dissolved in 1 pint of water, and ammonia is added until the solution reacts slightly alkaline.

Coloured Discharges.

A. For short steaming:

3—6	oz	colouring matter
10	,,	acetic acid
20	,,	gum thickening 1 : 1
12	,,	tannic acid in
12	,,	acetic acid
		dissolved in
40	,,	tin crystals discharge I or II.

B. For prolonged steaming:

3—6	oz	colouring matter
10	,,	acetic acid
20	,,	gum thickening 1 : 1
12	,,	tannic acid in
12	,,	acetic acid
		dissolved in
40	,,	discharge paste with acetate of tin (page 393).

Dyestuffs suitable for coloured discharges are as follows, for-

Yellow: Thioflavine T, Phosphine IIa, Paraphosphine G and R,
Pink: Irisamine G, Rosazeine 6 G,
Red: Safranine or Irisamine with Thioflavine T,
Blue: New Methylene Blue shaded if required with Methyl Violet BB72 No. 0,
Green: Brilliant Green or Solid Green with Thioflavine T,
Violet: Tannin Heliotrope, Methyl Violet BB72 No. 0, etc.,
Brown: Aniline Yellow.

The goods being printed with a coloured discharge are passed, after steaming or ageing in a Mather-Platt rapid ager, through a cold bath of tartar emetic or antimony salt. Discharges containing New Methylene Blue are to advantage passed through a cold bath of $1^{1}/_{2}$ oz bichrome per 10 gallons.

The discharges may be either diluted or thickened by adding tin crystals, according to the depth of the engravings of the printing roller. For light shades, especially, considerably weaker discharges should be used.

Any of the discharges may be also employed as resists for Aniline Black.

Acetate of tin is prepared as follows:

10 lbs stannous hydrate in paste are dissolved in
10—15 ,, acetic acid 11° Tw. and diluted to 28° Tw.
or,
36 oz tin crystals are dissolved in
16 ,, water and stirred into the hot solution of
59 ,, sugar of lead,
36 ,, water and
4 ,, acetic acid 11° Tw.;
when cool, the clear liquor is drawn off and diluted to 28° Tw.

Stannous hydrate is prepared as follows:

10 lbs tin crystals are dissolved in
4 gallons water
and precipitated with
$^{3}/_{4}$ gallon ammonia;
the temperature should not exceed 115° F.

After settling, the paste is washed several times by decantation and pressed off to a consistency of about 50% dry substance.

Zinc Dust Discharge.

33 oz zinc dust
42 ,, gum solution 1:1 } are mixed, ground well
5 ,, glycerine
and mixed before use with
6 ,, ammonia
19 ,, bisulphite 70° Tw.

If this discharge is to be employed for roller printing, the best qualities of zinc dust should be used and the discharge paste well ground in an indigo mill or other mill suitable for wet grinding.

For printing the discharge, a brush must be used along with the printing roller in order to prevent the zinc dust from clogging the engravings.

After printing, the goods are steamed for $^{1}/_{2}$—$^{3}/_{4}$ hour, then soured in water slightly acidulated with hydrochloric acid and well rinsed.

In the presence of dyestuffs sensititive to acids, some soda may be added to the rinsing bath.

The following dyestuffs may be added to the zinc dust discharge for coloured discharges:

Safranine
Phosphine
Methylene Blue BB
New Methylene Blue N.

The dischargeability of the Diamine Colours may be seen from the following list:

I. Easily dischargeable Diamine Colours:

Diamine Yellow N*)
Diamine Gold
Diamine Yellow CP
Diamineral Brown G
Diamine Brown S
Diamine Brown M, B and R
Diamine Catechine B, G and 3G
Diamine Bronze G
Diamine Grey G
Diamine Rose BD, BG and GD
Diamine Red 4 B and 10 B
Diamine Violet Red
Diamine Green B and G
Diamine Dark Green N
Diaminogene extra
Diaminogene B
Diamine Black BH
Diamine Black HW
Oxy Diamine Black A
Oxy Diamine Black JEI
Oxy Diamine Black JB
Oxy Diamine Black JW

Diamine Black BH
Diamine Beta Black B, BB
Diaminogene extra and B
developed with Beta-Naphtol
Diamine Blue Black E
Diamine Blue Black R
Diamine Blue 3 R
Diamine Azo Blue R
Diamine Blue BX
Diamine Blue RW
Diamine Brilliant Blue G
Diamine Blue BG
Oxy Diamine Blue G
Diamine Blue 2 B and 3 B
Diamine Sky Blue
Diamine Sky Blue FF
Diamine New Blue R
Diamine Blue C 4 B
Diamineral Blue R
Diamine Deep Blue R
Diamine Fast Blue C and CG
Diamine Steel Blue L

Is discharged most easily of all Yellows.

Diaminogene Blue BB and G Diamine Azo Blue R and 6B Diamine Blue Black E	developed with Beta-Naphtol.

II. Less easily dischargeable Diamine Colours:

Cotton Brown A and N
Oxy Diamine Brown G
Diamine Nitrazol Brown T
Diamine Brilliant Scarlet S
Diamine Red 5B and 6B
Diamine Fast Red F
Diamine Scarlet B and 3B
Diamine Red D
Diamine Bordeaux B and S
Diamine Violet N
Oxy Diamine Violet B, R and G
Diamine Heliotrope B
Oxy Diamine Blue 3R and R
Diamine Dark Blue B
Diamine Jet Black OO
Diamine Jet Black SS, Cr and RB
Oxy Diamine Black NF
Oxy Diamine Black SOOO
Oxy Diamine Black FFC
Oxy Diamine Black RR
Diamine Black BH
Diaminogene extra } developed with Phenylene Diamine or Resorcine.
Diaminogene B
Diamine Nitrazol Brown T } coupled with Nitrazol.

These colours can also be perfectly discharged if dyed in pale shades; only in the case of dark shades the white obtained is not always satisfactory. They may however for coloured discharges be employed both in light and in dark shades.

The zinc dust discharge acts more energetically than the tin crystals discharge and therefore yields good whites with the less easily dischargeable dyestuffs also.

Colours aftertreated with sulphate of copper behave similarly to those dyed direct, the white being only slightly duller in the case of the former.

Colours aftertreated with sulphate of copper and bichrome are only serviceable for coloured discharges.

Thioflavine S is neither dischargeable with tin crystals nor with zinc dust and is therefore used for producing yellow effects after discharging.

The Application of Acetate of Soda for Unions.

Cotton and wool mixed goods, which have been cross-dyed in an acid bath for dyeing the wool, are liable to retain part of the acid employed, however well they may be rinsed.

In order to prevent the detrimental action of the acid on the cotton during prolonged storing, it is recommended to add, after cross-dyeing with acid, $^1/_2$ lb acetate of soda per 10 gallons to the last rinsing bath and to dry without rinsing again.

The same treatment is recommended for unions bleached with sulphurous acid.

Instead of adding the acetate of soda to the rinsing bath the pieces may be padded with a solution of the same. The padding trough is charged with a solution of $^1/_2$ lb acetate of soda per 10 gallons of water and replenished by a gradual addition of 2 % calculated on the weight of the dry goods.

The rinsing and padding with acetate of soda is always done in cold baths.

The application of acetate of soda for unions dyed with sulphide colours is protected to us by patent and is placed free of cost at the disposal of buyers of our Immedial Colours.

This process has given the greatest satisfaction, neither the shade nor the quality of the wool suffering thereby in the least.

The Stripping of Dyeings with Hydrosulphite.

Hydrosulphite destroys a great many colouring matters, without, however, acting detrimentally on the cotton fibre; it may therefore in many cases be used for stripping.

Suitable stripping liquors are prepared by adding

4—8 gallons of a solution of hydrosulphite

to 100 gallons of water. The goods are entered into the bath, which is then heated to 120—140° F., and after $^1/_4$—$^1/_2$ hour's working are lifted and well rinsed.

Hydrosulphite is now a commercial article. As it however loses in strength during prolonged storing, it is best for dyers to prepare it for themselves. The method of preparation is described on page 414.

Water and Important Chemicals.

Water.

For all purposes of dyeing a high degree of purity of the water is very desirable. Apart from other impurities of less frequent occurrence, the sulphates of lime and magnesia and the bicarbonates of lime, magnesia and iron, constitute the so-called hardness of the water. They are detrimental to dyeing, as they precipitate dyestuffs, mordants and soap and may thereby cause stains and irregular results.

Condensed water is very suitable and pure. It may be easily collected in most dyehouses and does excellent service, especially for dissolving dyestuffs and in machine-dyeing. By means of an oil separator it may easily be freed of any oil occurring in isolated instances.

Rain water is also very good and serviceable, if it can be easily collected, as is also water from ponds and lakes if free from mud and other detrimental impurities.

Hard water is best purified by boiling with soda. Either the soda is added to the liquor before dyeing or dissolving, or the water is previously boiled in a separate vessel with soda and the precipitate allowed to settle.

The latter method is especially indispensable in the case of water of more than 22—25 degrees of hardness if intended for use in dyeing pale shades in a soap bath, or for machine-dyeing, or for soaping or oiling.

For purifying water by means of soda, a number of engineering works build special apparatus which have given great satisfaction generally. In the absence of an apparatus of this kind the purification may be effected in large wooden vats.

The water to be corrected is then mixed for each degree of hardness with a solution of 3 oz soda ash per 1000 gallons; for instance, with water of 20 degrees of hardness 60 oz soda per 1000 gallons are required. After boiling up well, the precipitate formed is allowed to settle and the clear soft water is used.

For purifying larger quantities of water it is best to employ two vessels, boiling up fresh water in one, whilst the precipitate is settling in the other.

A small excess of soda in the water will do no harm in dyeing or dissolving Diamine or Immedial Colours, but must be strictly avoided in dyeing with basic dyestuffs and also in after-treating with metallic salts. If an excess of soda be present, i. e. if the water reacts alkaline, it must be neutralised by carefully acidulating with acetic acid, until blue litmus paper is slightly reddened.

Sulphuric Acid.

Sulphuric acid is an oily colourless liquid (sometimes coloured brownish by the presence of small quantities of organic substances).

For dyeing, the ordinary commercial sulphuric acid, so-called "Oil of Vitriol" (O. V. or D. O. V., i. e. Double O. V.) is usually employed. It should contain 93—98 % pure sulphuric acid.

Fuming or Nordhausen sulphuric acid contains sulphuric anhydride and is not used in dyeing.

Sulphuric acid absorbs water from the air with great avidity and should therefore be kept in closed vessels. On mixing with water it evolves great heat. In order to avoid dangerous boiling up and spattering, sulphuric acid should always be diluted by being poured in a thin stream into a large quantity of cold water, stirring well all the time. The water must not be warm and on no account should water be poured into the strong acid. Sulphuric acid diluted with half its weight of water does not give off great heat on being further diluted.

Sulphuric acid is used sometimes in place of hydrochloric acid for souring in bleaching and for diazotising. It may be put down as a general rule that 1 part by weight of sulphuric acid replaces 2—2½ parts by weight of hydrochloric acid.

The strength of sulphuric acid may be determined with the hydrometer according to the following table.

Specific Gravity of Sulphuric Acid at 59° F.

(Lunge and Isler.)

Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid	Degrees Twaddle	Per cent sulphuric acid
2	1.57	48	32.28	94	56.90	140	77.17
4	3.03	50	33.43	96	57.83	142	78.04
6	4.49	52	34.57	98	58.74	144	78.92
8	5.96	54	35.71	100	59.70	146	79.80
10	7.37	56	36.87	102	60.65	148	80.68
12	8.77	58	38.03	104	61.59	150	81.56
14	10.19	60	39.19	106	62.53	152	82.44
16	10.90	62	40.35	108	63.43	154	83.32
18	12.99	64	41.50	110	64.26	156	84.50
20	14 35	66	42.66	112	65.08	158	85.70
22	15.71	68	43.74	114	65.90	160	86.90
24	17.01	70	44.82	116	66.71	162	88.30
26	18.31	72	45.88	118	67.59	164	90.05
28	19.61	74	46.94	120	68.51	165	91.00
30	20.91	76	48.00	122	69.43	166	92.10
32	22.19	78	49.06	124	70.32	167	93.43
34	23.47	80	50.11	126	71.16	168	95.60
36	24.76	82	51.15	128	71.99	168.3*	97,70
38	26.04	84	52.15	130	72.82	168.1*	98.70
40	27.32	86	53.11	132	73.64	168*	99.20
42	28.58	88	54.07	134	74.51	167.7*	99.95
44	29.84	90	55.03	136	75.42		
46	31.11	92*	55.97	138	76.30		

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*) Sulphuric acid of 97,70 °/$_0$ has the highest specific gravity, whilst that of stronger acid is a little lower.

Hydrochloric or Muriatic Acid or Spirits of Salts.

Hydrochloric or muriatic acid appears in commerce either as a colourless liquid or coloured greenish yellow by traces of iron. The commercial acid usually has a specific gravity of 26—38° Tw. and is contaminated with iron, arsenic, sulphuric acid and organic matter. For general dyeing it is sufficiently pure, but for Paranitraniline Red the use of pure acid of 34—36° Tw. is recommended.

Unlike sulphuric acid, hydrochloric acid forms a freely soluble lime salt (calcium chloride) and is therefore generally to be given the preference over sulphuric acid in souring off for the purpose of removing lime salts.

Hydrochloric acid is used in dyeing for a great variety of purposes, amongst others for preparing the diazotising baths.

The strength of the hydrochloric acid can be determined with the hydrometer according to the following table.

Specific Gravity of Hydrochloric Acid at 59° F.
(Lunge and Marchlewski.)

Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid	Degrees Twaddle	Per cent hydrochloric acid
1	1.15	11	11.18	21	20.97	31	30.55
2	2.14	12	12.19	22	21.92	32	31.52
3	3.12	13	13.19	23	22.86	33	32.49
4	4.13	14	14.17	24	23.82	34	33.46
5	5.15	15	15.16	25	24.78	35	34.42
6	6.15	16	16.15	26	25.75	36	35.39
7	7.15	17	17.13	27	26.70	37	36.31
8	8.16	18	18.11	28	27.66	38	37.23
9	9.16	19	19.06	29	28.61	39	38.16
10	10.17	20	20.01	30	29.57	40	39.11

It will be noticed that each degree Twaddle indicates approximately 1 °/₀ pure hydrochloric acid.

Acetic Acid.

Acetic acid is produced by the destructive distillation of wood. The pure concentrated acetic acid solidifies at ordinary temperature and forms crystals of ice-like appearance. It is therefore called glacial acetic acid. On account of its high price it is not used for dyeing purposes.

Commercial acetic acid is a colourless liquid usually containing 30—50 % pure acetic acid. It contains from its preparation pyroligneous substances and traces of mineral acids in addition to water, or it may be adulterated intentionally by mineral acids. An admixture of the latter is liable to be especially injurious in acetic acid used for brightening or scrooping cotton goods, as the mineral acids may affect the cotton during storing. For such purposes therefore acetic acid warranted free from mineral acids should always be used, whilst for most other purposes a small admixture of mineral acids is of no consequence.

Acetic acid is used in cotton dyeing for acidulating liquors for mordanting, dyeing and aftertreating, particularly in order to neutralise the alkaline action of soda and calcium carbonate when aftertreating with metallic salts and when dyeing with basic dyestuffs, and also to cause the basic dyestuffs to go more slowly and evenly on the fibre. It is also used to impart a silky scroop to mercerised cotton.

The hydrometer is not satisfactory for an exact determination of the strength of acetic acid, but it is frequently employed in order to approximately estimate its strength.

Specific Gravity of Acetic Acid at 59° F.

(Oudemans.)

Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle	Per cent acetic acid	Degrees Twaddle
5	1.3	25	7.0	45	11.4	65	14.3	85	14.8
10	2.8	30	8.2	50	12.3	70	14.7	90	14.3
15	4.3	35	9.4	55	13.1	75	14.9	95	13.2
20	5.7	40	10.5	60	13.7	80	15.0	100	11.1

The specific gravities above 11° Tw. correspond to two liquids of different strengths. To ascertain whether the acid contains more or less than 77 % pure acetic acid, a small quantity of water should be added after measuring; if, on again measuring, a higher specific gravity is found, the acid contains more than 77 %, otherwise less.

Tartaric Acid.

Tartaric acid is on the market in the form of large colourless crystals, easily soluble in water. In cotton dyeing it is used especially for scrooping mercerised cotton, for which purpose it should be free from mineral acids.

Caustic Soda or Sodium Hydrate; Caustic Soda Lye.

Caustic soda or sodium hydrate is sold in the form of a white molten mass, packed in iron drums. It is very freely soluble in water and absorbs with avidity water even from the air, which causes it to liquefy at first, but by attracting carbon dioxide from the air, thus forming sodium carbonate, it soon again solidifies. It is very caustic and has a caustic alkaline taste.

The commercial product usually contains 77—79 % pure sodium hydrate.

Caustic soda lye is the aqueous solution of caustic soda.

Caustic soda and caustic soda lye are used for boiling off cotton and as additions in the dyeing of some colours, e. g. Immedial Blue and also for dissolving certain developers. Both are also very important for the process of mercerising cotton and for the preparation of soap.

The following table may serve for determining the strength of caustic soda lye by means of the hydrometer. It will be noticed, however, that this instrument does not indicate the amount of soda, salt or Glauber's salt which the lye may contain, although such impurities increase the specific gravity.

Specific Gravity of Caustic Soda Lye at 59° F.

(Schiff and Gerlach.)

Per cent Sodium Hydroxide	Degrees Twaddle	Per cent Sodium Hydroxide	Degrees Twaddle	Per cent Sodium Hydroxide	Degrees Twaddle
1	2.4	21	47.2	41	89.4
2	4.6	22	49.4	42	91.5
3	7.0	23	51.6	43	93.6
4	9.2	24	53.8	44	95.6
5	11.8	25	55.8	45	97.6
6	14.0	26	58.0	46	99.8
7	16.2	27	60.0	47	101.6
8	18.4	28	62.0	48	103.8
9	20.6	29	64.2	49	105.8
10	23.0	30	66.4	50	108.0
11	25.2	31	68.6	51	110.0
12	27.4	32	70.2	52	112.0
13	29.6	33	72.6	53	114.0
14	31.8	34	74.8	54	116.0
15	34.0	35	76.8	55	118.2
16	36.2	36	79.0	56	120.2
17	38.4	37	81.0	57	122.2
18	40.4	38	83.0	58	124.4
19	42.6	39	85.2	59	126.6
20	45.0	40	87.4	60	128.6

Ammonia, Ammonium Hydrate, Ammonia Liquor.

Commercial ammonia or ammonia liquor is the colourless aqueous solution of gaseous ammonia and is distinguished by its very pungent smell. It has a specific gravity of about 0.92 and is consequently lighter than water.

The gaseous ammonia is expelled from the solution by heat and will even evaporate naturally if the solution is left unprotected. Gaseous ammonia can also be liquefied by pressure and is sold as an almost pure liquid in steel cylinders under the name of anhydrous ammonia.

Ammonia has very strong alkaline properties and turns red litmus blue; it neutralises all acids, combining with them to form salts. It evinces a much milder action than caustic soda lye and offers the great advantage that an excess easily evaporates and consequently in many cases exerts no injurious effect.

Ammonia is used for neutralising acids, fixing mordants and for other purposes.

The strength of ammonia is usually estimated with the hydrometer, for which purpose the following table may be used.

Specific Gravity of Ammonia (Ammonia Liquor) at 59° F.

(Lunge and Wiernik.)

Specific gravity at 59° F.	Per cent (gaseous) ammonia	Specific gravity at 59° F.	Per cent (gaseous) ammonia	Specific gravity at 59° F.	Per cent (gaseous) ammonia
1.000	0.00	0.960	9.91	0.920	21.75
0.995	1.15	0.955	11.34	0.915	23.36
0.990	2.31	0.950	12.74	0.910	24.99
0.985	3.55	0.945	14.22	0.905	26.65
0.980	4.80	0.940	15.63	0.900	28.33
0.975	6.05	0.935	17.12	0.895	30.03
0.970	7.31	0.930	18.64	0.890	31.75
0.965	8.59	0.925	20.18	0.885	33.68

Sodium Sulphide.

Sodium sulphide is found in two forms in commerce, viz. as crystallised and as concentrated sodium sulphide. Crystallised sodium sulphide consists of brownish crystals containing water of crystallisation and 32 1/2 per cent pure sodium sulphide. The concentrated product has usually double the strength and is sold in the form of grey or greyish black irregular lumps, as well as in the solid form in drums.

Sodium sulphide is very freely soluble in cold or warm water. It absorbs from the air moisture, carbon dioxide and oxygen, liquefies and becomes partially converted into carbonate and sulphate of soda. As it thereby loses correspondingly in strength, it should be stored if possible in well closed vessels and not be kept too long in stock.

Sodium sulphide is used for dissolving sulphide colours; its application is described on page 124.

Soda or Soda Ash, Sodium Carbonate or Carbonate of Soda.

Soda is usually sold as a white powder (soda ash, Solvay or ammonia soda) or in the shape of crystals (soda crystals, crystal carbonate). It is chiefly manufactured by the old Leblanc process or by the more recent Solvay or ammonia process and now also by electrolysis. Before the introduction of the Solvay process, Leblanc soda was frequently very impure and contained amongst other impurities caustic soda and sodium sulphide, whilst Solvay soda, apart from salt, cannot contain any soluble impurities deriving from its manufacture. For this reason Solvay or ammonia soda is frequently preferred for dyeing purposes; Leblanc soda has however also been manufactured in excellent purity for years past.

Soda crystals is crystallised soda containing about 36 % pure sodium carbonate and 63 % water of crystallisation; also small quantities of Glauber's salt, but no detrimental impurities. Being a relatively expensive product and having no other advantages over good soda ash than that of always possessing approximately uniform strength and dissolving readily in water without forming hard lumps, it is not used very much in dyeing. Excellent qualities of soda ash are now brought into commerce.

Crystal carbonate is also pure crystallised soda containing only 18 % water of crystallisation.

Soda is staple on exposure to air. Soda ash easily forms hard lumps in moist air, without however absorbing any considerable quantities of water. It has a less caustic taste and a milder alkaline action than caustic soda. It is neutralised by most acids, such as sulphuric, hydrochloric or acetic acid with evolution of carbon dioxide, and an addition of acids therefore causes an effervescing of the solutions.

Soda dissolves most copiously in water of 90° F.

100 parts of water dissolve the following quantities of pure sodium carbonate at:

32°	41°	50°	59°	68°	86°	90°	93° and 174°	212° F.
7.1	9.5	12.6	16.5	21.4	38.1	59	46.2	45.1 Soda.

Soda ash is put on the market in various degrees of strength, calculated on the supposed percentages of sodium oxide. The chief brands show 48°, 52–56° and 58°, each degree indicating 1 per cent of sodium oxide, 58° consequently corresponding to about 99 per cent of pure sodium carbonate. The usual qualities of 56–58° are pure enough for all dyeing purposes.

Our observations on soda ash have reference to the latter qualities, irrespective of the process by which they are produced. 100 parts of good soda ash are approximately equivalent to 270 parts soda crystals.

The strength of pure soda solutions may be determined with the hydrometer, according to the following table. It must, however, be observed that any impurities present, such as salt, Glauber's salt or sodium sulphide are not separately indicated.

Specific Gravities of Solutions of Sodium Carbonate at 59° F.

Degrees Twaddle	Per cent Sodium carbonate	Degrees Twaddle	Per cent Sodium carbonate	Degrees Twaddle	Per cent Sodium carbonate
1	0.47	11	5.23	21	9.90
2	0.95	12	5.71	22	10.37
3	1.42	13	6.17	23	10.83
4	1.90	14	6.64	24	11.30
5	2.38	15	7.10	25	11.76
6	2.85	16	7.57	26	12 23
7	3.33	17	8.04	27	12.70
8	3.80	18	8.51	28	13.16
9	4.28	19	8.97	29	13.63
10	4 76	20	9.43	30	14.09

Glauber's Salt, Sodium Sulphate or Sulphate of Soda.

Glauber's salt is used in the form of calcined (or desiccated) and crystallised Glauber's salt. Calcined Glauber's salt is sometimes impure, containing especially an excess of sulphuric acid. Crystallised Glauber's salt contains, if chemically pure, 44.1 % anhydrous salt and 55.9 % water; the commercial product is fairly pure. The crystallised salt is efflorescent in the air, losing its water of crystallisation. 100 parts of calcined Glauber's salt are equivalent to 220 parts of crystallised Glauber's salt.

100 parts of water dissolve at:

32°	50°	59°	68°	77°	86°	91½°	104°	217½° F.
5	9	13	19	28	40	50	49	42.6 parts of calcined Glauber's salt.

Specific Gravities of Aqueous Solutions of Calcined Glauber's Salt at 59° F.

Per cent calc. Glauber's salt	Specific Gravity	Per cent calc. Glauber's salt	Specific Gravity	Per cent calc. Glauber's salt	Specific Gravity
1	1.0091	5	1.0457	9	1 0832
2	1.0182	6	1.0550	10	1.0927
3	1 0274	7	1.0644	11	1.1025
4	1.0365	8	1 0737	12	1.1117 saturated

The percentages of crystallised Glauber's salt are found by multiplying the above percentages by 2¼.

Glauber's salt must not be acid (i. e. it must not redden moistened blue litmus paper), as Diamine and Immedial Colours are precipitated by acids. Glauber's salt, if used in dyeing machines, must be completely soluble, and crystallised Glauber's salt should therefore be given the preference for machine-dyeing.

Common Salt, Sodium Chloride (Rock Salt.)

Common salt is obtained from rock salt, brine, sea water etc. It crystallises without water of crystallisation, but usually contains a little moisture and frequently also sodium sulphate, calcium sulphate and magnesium chloride. Its solubility is nearly the same at all temperatures and varies only between 35.5 parts of salt at 32° and 39.2 parts at 212° F. in 100 parts of water. The specific gravity of solutions of common salt in water at 59° F., according to Gerlach, is:

Per cent common salt	5	10	15	20	25	26.4 saturated.
Specific gravity	1.0362	1.0733	1.1114	1.1510	1.1923	1.2043.

Common salt is used in cotton dyeing for the same purposes as Glauber's salt. In machine-dyeing, crystallised Glauber's salt is preferable to common salt, as the inferior qualities of the latter, used in dye-houses, frequently contain small quantities of calcium sulphate; but in almost all other cases common salt may be used instead of crystallised or calcined Glauber's salt.

Sodium Nitrite (Nitrite) or Nitrite of Soda.

Sodium nitrite forms small, readily soluble, but not deliquescent, crystals containing 95—98 % nitrite.

It is used in cotton dyeing for diazotising dyestuffs which are to be developed, and also for diazotising Paranitraniline. Its action is based on the liberation of nitrous acid on the addition of mineral acids, such as hydrochloric or sulphuric acid; acetic acid has not the same effect. For 1 part of nitrite, 3 parts of hydrochloric acid or 2 parts of sulphuric acid are used.

Sodium Acetate or Acetate of Soda.

This salt forms clear and very readily soluble crystals which slowly lose their water of crystallisation through exposure to air. It serves for neutralising free mineral acids, forming their salts and liberating free acetic acid, and is used, for instance, for developing Paranitraniline Red or for preparing the solution of diazotised Paranitraniline or Nitrazol respectively. For union goods which have been cross-dyed in an acid bath, a final impregnation with acetate of soda is very useful for the maintenance of the strength of the cotton fibre, and an addition of acetate of soda to the last bath used for rinsing cotton goods dyed with Immedial Black is also advisable.

Sodium Phosphate or Phosphate of Soda.

Crystals which effloresce in the air and are soluble in 25 times their weight of cold water, or in their own weight of boiling water. Phosphate of soda is a mild alkaline salt sometimes used in place of Glauber's salt for dyeing Diamine Colours in light shades.

Borax, Sodium Bi-borate or Bi-borate of Soda.

White crystals with water of crystallisation, or white powder when anhydrous, fairly soluble in water. Feebly alkaline salt, sometimes used in place of soda, phosphate of soda etc. It is also used to render cotton goods incombustible.

Sodium Silicate or Silicate of Soda, Soluble Glass.

Silicate of soda is usually sold as a colourless or slightly coloured vitreous mass or as a sirupy, aqueous solution. It frequently contains, from its preparation, an excess of caustic soda. It is very readily soluble in water, but not deliquescent. The solution is decomposed by the action of the carbon dioxide of the air, separating silicic acid. Sodium silicate is also used as an alkaline salt, especially for fixing mordants. It is extensively used for rendering textile goods both incombustible and waterproof.

Sodium Tungstata or Tungstate of Soda.

White crystals soluble in 4 parts of cold or in 2 parts of hot water. It is a feebly alkaline salt which is used not so much for dyeing as for rendering goods incombustible, and for producing the so-called opaline prints.

Sodium Chlorate or Chlorate of Soda.

Colourless crystals soluble in their own weight of cold or half their weight of hot water, and consequently much more readily soluble than the corresponding potassium salt. Otherwise both salts possess exactly the same properties. Chlorate of soda is a strong oxidising agent, chiefly employed in cotton dyeing for producing aniline oxidation black, and for discharging.

Sodium Bisulphite or Bisulphite of Soda.

White crystals decomposing in the air with development of heat, usually termed Meta-Sulphite or Pyro-Sulphite.

In dyeing, the aqueous solution of sodium bisulphite is used almost exclusively. It forms a colourless liquid or yellowish solution, tinted by traces of iron, and smelling of sulphur dioxide, of which it usually contains 20—23 % and stands at about 64° Tw. Bisulphite of soda is chiefly used for preparing hydrosulphite for vat dyeing. It is also sometimes employed for removing chlorine from bleached goods.

Sodium Hydrosulphite or Hydrosulphite of Soda.

Sodium hydrosulphite is only with difficulty prepared in its pure solid state and is used as an aqueous solution prepared by the action of zinc clippings or zinc dust on bisulphite of soda. It very rapidly oxidises and should therefore be protected as well as possible from the action of the air, by being kept in barrels or bottles well filled and tightly closed.

It serves for stripping colours off dyed goods and is prepared for this purpose by pouring a mixture of 1 gallon bisulphite of 64° Tw and 1 gallon cold water over 1 lb zinc dust, stirring well for a short time, allowing the precipitate to settle and using the clear or, if necessary, filtered liquor. For stripping, 1—1 $^1/_2$ gallon hydrosulphite and 1 pint acetic acid are added to 25 gallons water before entering the material. The bath is heated to 120—140° F. and the material worked for about $^1/_4$ — $^1/_2$ hour, until the dye is sufficiently removed from the material. In this way many colours may be destroyed or at least considerably reduced.

(Hydrosulphite is sometimes erroneously called "hyposulphite of soda".)

Sodium Thiosulphate, Thiosulphate or Hyposulphite of Soda, Antichlorine.

Sodium thiosulphate is a well crystallised and readily soluble salt. It is decomposed by acids, sulphur being separated and sulphur dioxide given off. It is frequently used to prevent the injurious action of hypochlorous acid (chlorine) on bleached goods. It has also been recommended for increasing the fastness to light of Diamine Colours (see page 70).

Calcium Chloride.

Calcium chloride is a very readily soluble salt formed by the action of hydrochloric acid on lime or chalk and is a waste product in many chemical works. It sometimes serves as a substitute for magnesium chloride in finishing, as it does not generate hydrochloric acid by the action of heat.

Barium Chloride.

Colourless crystals soluble in three times their weight of cold and somewhat more freely in hot water. Barium chloride is poisonous. It is sometimes used for weighting cotton goods.

Magnesium Chloride.

Very readily soluble and deliquescent crystals which decompose on being heated in the presence of moisture, thereby generating hydrochloric acid. By hot finishing on the calander, magnesium chloride may be decomposed, and by generating hydrochloric acid, as previously mentioned, may tender the fibre; its application is therefore not without risks, and calcium chloride or Epsom salts are sometimes used in its place. It is frequently added to the size for cotton warps and pieces, in order to prevent the goods from becoming mouldy, and also for weighting purposes.

Epsom Salts, Magnesium Sulphate or Sulphate of Magnesia.

Epsom salts is used as a readily soluble salt which comes into commerce in the shape of crystals or as a crystalline powder. It is sometimes used as an addition to finishing sizes, when magnesium chloride is not applicable on account of its liability to tender the fibre (see above), and it should therefore not contain any magnesium chloride.

Alum.

Commercial alum is either potash alum or ammonia alum, which show hardly any practical difference in their properties.

It is used in the case of basic dyestuffs to cause them to dye slowly and evenly.

The solubility of alum may be seen from the following table:

100 parts of water dissolve at:

50°	68°	86°	104°	158°	212° F.
9.5	15.1	22.0	30.9	90.7	357.5 parts potash alum
9.1	13.6	19.3	27.3	72.0	421.9 parts ammonia alum.

Aluminium Sulphate or Sulphate of Alumina.

Sulphate of alumina has the same properties as alum, but is stronger, 100 parts of sulphate of alumina being approximately equivalent to 140—150 parts of alum. Sulphate of alumina sometimes contains an excess of sulphuric acid and small quantities of iron and Glauber's salt. It usually contains 50 % pure aluminium sulphate, sometimes even more than 55 per cent.

Aluminium Acetate or Acetate of Alumina.

Acetate of alumina is known in solution only and is usually prepared by mixing solutions of aluminium sulphate and of lead acetate (sugar of lead) or acetate of lime. For 100 lbs of aluminium sulphate, 171 lbs of sugar of lead are used; the two solutions are mixed, and after the precipitate has settled, the clear solution is drawn off for use. In order to free the solution completely from lead, a small quantity of Glauber's salt in solution may subsequently be added.

Chrome-Alum.

Chrome-alum, obtained as a waste product in various chemical works, forms dark crystals which may contain, notwithstanding their beautiful crystalline appearance, a great many impurities, particularly calcium sulphate, tarry and other organic matters and free sulphuric acid.

One part of chrome-alum dissolves in 7 parts of cold or 2 parts of boiling water. Chrome-alum is frequently used for fixing Diamine Colours and Immedial Black, for the latter chiefly in order to produce a more greenish shade than is obtained with bichrome.

Chromium Fluoride or Fluor Chrome.

Chromium Fluoride is a green crystalline powder which is readily soluble in both cold and hot water and has a corroding action on glass and on most metals.

Chromium fluoride is chiefly used for the aftertreatment of various Diamine Colours, e. g. Diamine Green G, in order to render them fast to washing.

Chromium Acetate or Acetate of Chrome.

Chromium acetate is prepared by dissolving chromium hydrate in acetic acid or by decomposing chrome-alum with sugar of lead, and is chiefly used for fixing various colours in calico printing. It is exceedingly soluble in water.

Bichrome or Chrome. Potassium Bichromate. Red Chromate or Bichromate of Potash.

Bichrome forms large yellowish red crystals which are staple on exposure to air and do not contain any water of crystallisation. 100 parts of water dissolve at

32°	50°	104°	176°	212° F.
5	8.5	29.4	73	102 parts bichrome.

Commercial bichrome is almost chemically pure. Bichrome is used in cotton dyeing for aftertreating Diamine and Immedial Colours.

Sodium Bichromate or Bichromate of Soda. Bichrome or Chrome.

Sodium bichromate contrary to potassium bichromate forms deliquescent crystals containing water of crystallisation; it is more easily soluble in water than the potassium salt, and for this reason is now frequently used in place of the latter.

It is usually brought into commerce equal to the potassium salt in strength, but not always in purity. 100 parts of water dissolve at

32°	59°	86°	176°	212° F.
107	109	127	143	163 parts sodium bichromate.

Copperas or Green Vitriol. Ferrous Sulphate or Sulphate of Iron.

Ferrous sulphate is formed by dissolving iron in diluted sulphuric acid. Copperas, the commercial product, is produced on a large scale from pyrites. It appears as bluish green crystals which effloresce on exposure, becoming brownish through oxidation. It is readily soluble in water, but it is rapidly oxidised by the action of the air, red ferric hydroxide separating.

Copperas is used in cotton dyeing chiefly for the preparation of the copperas vat, and for fixing tannins for basic dyestuffs and dye-woods.

Pyrolignite of Iron. Iron Liquor or Black Liquor.

Pyrolignite of iron is a dark olive brown liquid with a peculiar smell. The commercial product has usually the specific gravity of 20—30° Tw. It is sometimes used in place of copperas in the application of basic dyestuffs.

Nitrate of Iron. Ferric Sulphate.

Nitrate of iron derives its name from its being sulphate of iron oxidised by means of nitric acid. It is however not a nitrate but a sulphate, and comes into commerce as an aqueous solution of about 77° Tw. It sometimes serves for the aftertreatment of tannins for basic dyestuffs in place of copperas, and for dyeing buff shades.

Tin Crystals or Tin Salt. Stannous Chloride.

This salt is prepared by dissolving tin in hot hydrochloric acid. It is dissolved completely by $^1/_3$ of its weight of water; the clear solution becomes turbid on addition of water by dissociation of the salt, but clear again on addition of hydrochloric acid.

Tin crystals are very largely used for discharging Diamine Colours.

Stannic Chloride. Tin Spirits.

Stannic chloride is mostly used in solution or as a double salt of ammonium chloride, called pink salt. It is very freely soluble in water and is used for fixing tannins for basic dyestuffs, which on tannin and stannic compounds yield shades practically as fast as on tannin and antimony.

Zinc Vitriol or Zinc Sulphate.

Very readily soluble in water and sometimes used as an addition to sizes for cotton warps and pieces.

Zinc Chloride.

Zinc chloride is very readily soluble and deliquescent. It serves also as an addition to sizes, on which it has an antiseptic action.

Zinc Acetate.

Zinc acetate forms crystals readily soluble in water and has been recommended as a fixing agent of tannins for basic dyestuffs. It is best used in the form of a solution, prepared by adding 8—10 parts zinc vitriol and 4—5 parts acetate of soda to 100 parts water.

Blue Stone or Blue Vitriol. Copper Sulphate or Cupric Sulphate.

Blue transparent crystals fairly soluble in water:

100 parts of water dissolve at:

50°	68°	86°	122°	158°	194°	212°	F.
37	42	49	66	95	156	203	parts blue stone.

Blue stone is very extensively used for aftertreating Diamine and Immedial Colours. For Diamine Colours it is either used by itself or together with bichrome. For Immedial Colours it must always be used in combination with bichrome.

In using blue stone, care must be taken that the baths do not become turbid, which is easily prevented by the addition of sufficient acetic acid. Blue stone improves the fastness to light of many (but not all) dyes in a very marked degree.

Nickel Acetate.

Green, readily soluble crystals, which may be used in place of blue stone for aftertreating certain Diamine Colours (see page 69).

Cobalt Acetate.

Violet, readily soluble crystals which may be used in the same way as nickel acetate (see above).

Tartar Emetic.

Tartar emetic, the double tartrate of antimony and potassium, is a crystalline salt which is not very soluble in cold water, but more freely so in hot water. One part of tartar emetic requires for dissolving at:

47°	70°	88°	122°	167° F.
19	12 6	8.2	5.5	3.2 parts of water.

Tartar emetic serves for fixing tannins for dyeing basic dyestuffs.

The active substance of tartar emetic is antimony trioxide, of which the pure salt contains 43.4 per cent. The commercial product consists of fine crystals or irregular lumps containing 43 % antimony trioxide; it is not unfrequently adulterated with cheap salts of antimony, or even with entirely valueless substances.

Tartar emetic and the rest of the salts of antimony are poisonous; no ill effects need however be feared, if the goods are rinsed fairly well, as many years' experience has proved.

The valuation of tartar emetic and other salts of antimony depends chiefly on their percentage of antimony trioxide and requires an exact chemical analysis.

Substitutes for Tartar Emetic.

Tartar emetic is a rather costly commodity on account of the expensive tartar required for its preparation, and it is therefore successfully replaced by cheaper salts of antimony, which have the same effect. The substitutes for tartar emetic most generally used are some double fluorides of antimony, antimony oxalate and antimonine.

Antimony salt, a double salt of antimony fluoride and ammonium sulphate (from E. de Haën at List near Hannover) forms white crystals, of which 140 parts are soluble in 100 parts of water. The solution reacts strongly acid and corrodes glass and metals. Antimony salt contains 47% antimony trioxide, and 9 parts of antimony salt are therefore nearly equivalent to 10 parts of tartar emetic.

Patent salt or double antimony fluoride (of R. Koepp & Co. at Oestrich, Rheingau) is antimony-sodium fluoride. It is also a crystalline and very readily soluble salt which likewise corrodes glass and metals. It contains 66 % antimony trioxide, and consequently 65.8 parts of double antimony fluoride are equivalent to 100 parts of tartar emetic.

In addition to these two products various other double salts of antimony fluoride are used more or less.

Of the double salts of antimony fluoride 5—20 parts are dissolved in 1000 parts of water, and in order to neutralise their very strong acidity, 6—8 per cent of their weight of soda ash are added, just enough to render the bath turbid.

Antimony oxalate, the double oxalate of potassium and antimony has been introduced as the first cheap substitute of tartar emetic; it has given much satisfaction, but has been superseded by the double fluorides. It forms crystals very soluble in water and dissociates rapidly into insoluble basic oxalate of antimony and soluble bin-oxalate. It contains only 25.1 % antimony trioxide as against 43.4 % in tartar emetic; it is said however to replace equal weights of the latter, as it combines more rapidly with tannic acid.

Antimonine (C. H. Boehringer Sohn, Ingelheim o. Rh.) is the double lactate of antimony and calcium. It is sold in a crystalline form containing 15 % antimony trioxide, is hygroscopic and very readily soluble. It should be employed like the other substitutes of tartar emetic, but in a weakly acid solution, viz:

with the addition of 2 gallons acetic acid per 1000 gallons of liquor. The product is fairly extensively employed.

Bleaching Powder or Chloride of Lime. Calcium Hypochlorite.

Bleaching powder is a white powder smelling of chlorine; it should be free of lumps. It becomes moist on exposure to air, absorbs carbon dioxide and forms then a doughy mass. It develops heat when stirred with a little water and dissolves in twenty times its weight of water, but always leaves a considerable insoluble residue. Good bleaching powder contains 35—39 % active chlorine. It slowly decomposes when stored, thereby losing in strength. The decomposition may even take place with an explosive violence.

For preparing a solution of chloride of lime, 1 part of bleaching powder is mixed with 3 parts of water to a paste and diluted with 3 parts more water; after settling, the clear solution is diluted to the desired strength.

Chloride of lime is used for bleaching, and only a perfectly clear solution should be used, as a depositing of lumps will damage the goods. To enhance the effect of the bleaching solution it is either faintly acidulated or the chlorinated goods are exposed to the air, the carbon dioxide of which brings out the full effect of the hypochlorous acid. After the treatment with bleaching powder and acids the goods must always be rinsed well, if necessary with the addition of a so-called "antichlor" such as sodium thiosulphate or bisulphite.

Sodium Hypochlorite. Hypochlorite of Soda. Eau de Javelle. Eau de Labarracque.

Sodium hypochlorite is known only in the form of its aqueous solution, which is produced either by the electrolysis of common salt or by mixing the solutions of chloride of lime and of soda carbonate.

100 lbs of chloride of lime 33 % are mixed with 40 gallons of water, and 60 lbs of soda ash are dissolved in 20 gallons of boiling water and diluted with 10 gallons of cold water. The soda solution is added to the paste of chloride of lime, the mixture stirred for 1/2 hour and allowed to settle over night. The clear solution is drawn off and the precipitate washed 4 or 5 times with cold water, the wash waters being used to dilute the solution to 150 gallons of 6—7 ° Tw. It may be entirely freed from lime by the addition of 1 to 2 lbs soda ash, which precipitates the remaining lime. The solution reacts somewhat alkaline and may be neutralised by an addition of 1 1/4 to 1 1/2 lbs sulphuric acid to each 100 gallons of liquor.

Hypochlorite of soda is used for bleaching all kinds of cotton goods.

Hydrogen Peroxide.

Hydrogen peroxide is used as a colourless aqueous solution prepared by decomposing barium peroxide, or sometimes sodium peroxide, with dilute sulphuric acid. The action of hydrogen peroxide is based on its property of readily developing oxygen, and it is therefore used as a bleaching agent. The strength of the commercial solution is usually expressed in volumes of oxygen evolved by 1 volume of the liquid, the usual strength of 12 volumes corresponding to 3 % hydrogen peroxide.

The product keeps best at a low temperature in a dark place and acidulated with small quantities of acid. An addition of 1 1/2 oz Naphtalene or 1 pint alcohol or ether to 10 gallons of the solution are favourable to its stability. It readily gives off the oxygen in the presence of alkalis or on heating. Some metals also exert a decomposing action on hydrogen peroxide, and it is therefore best kept in well-tarred casks or in carboys.

Hydrogen peroxide, as mentioned, serves for bleaching and is also used for developing Immedial Blue (see page 131).

Sodium Peroxide.

Sodium peroxide is a white powder, deliquescent in the air and absorbing carbon dioxide, liberating oxygen. It dissolves in water with evolution of heat, and on boiling gives off oxygen. On dissolving in sufficiently cooled, acidulated water it forms hydrogen peroxide and the corresponding sodium salt, and it is therefore used for bleaching in place of hydrogen peroxide. In contact with combustible substances it ignites them and should therefore be handled with care.

In cotton dyeing, sodium peroxide is used for bleaching and, in isolated cases, for developing Immedial Blue.

Sodium peroxide develops 20 % oxygen, whilst hydrogen peroxide of 12 per cent of volume yields but 1 1/2 % oxygen; furthermore sodium peroxide, contrary to hydrogen peroxide, may be kept a very long time, if well stored.

Potassium Permanganate or Permanganate of Potash.

Potassium permanganate forms almost black crystals with a steel blue lustre and dissolves with an intense crimson colour in 15 or 16 parts of cold water.

It is a very powerful oxidising agent and is therefore sometimes used for bleaching, brown manganese dioxide being deposited on the fibre. By sulphurous acid or an acidulated solution of bisulphite, the manganese dioxide is, however, easily dissolved and removed.

Soap.

Soaps are usually classified as hard or soda soaps and soft or potash soaps. The latter contain almost all impurities of the raw materials, the surplus of alkali and glycerine, and are only used in cases where these impurities are unimportant, and especially where the disagreeable smell, which they impart to the goods, is not objected to.

By "hard" soaps, purified soaps are unterstood, which have been freed, though often only imperfectly, from an excess of alkali and glycerine.

In cotton dyeing, olive oil soap is usually employed, which is prepared from olive oil and caustic soda lye, and should be free from an excess of alkali, glycerine and ill-smelling fats. It is especially used in cases where the goods are not to be rinsed after dyeing and are required to remain odourless.

In other cases hard soaps prepared of tallow or soft soaps are also used.

Turkey-Red Oil.

Turkey-red oil is produced by a treatment of castor oil with sulphuric acid and comes into commerce as an oily liquid containing about 50 % Turkey-red oil, which is readily soluble in water containing caustic soda lye or ammonia. It is used for various purposes in dyeing, and serves, for instance, to facilitate the levelling of Diamine and Immédial Colours on mercerised cotton. Compared with soap, which is frequently used for the same purpose, it has the advantage of less readily forming precipitates in calcareous water.

Tannins.

By this general name a number of organic acids found in the vegetable kingdom are described. They resemble each other in their chemical characteristics and are generally distinguished by their property of tanning animal skins, i. e. converting them into leather, of precipitating albumen and glue, alkaloids and basic dyestuffs from their solutions, and of yielding blue black or dark green colorations with ferric acetate. They have also a very astringent taste, a feeble acid reaction on litmus, and are powerful reducing agents.

In dyeing, the tannins are chiefly used as mordants or for weighting purposes owing to their property of forming insoluble compounds with many metallic oxides and colouring matters. (Cutch and gambier also belong to the tannins.)

The majority of the tannins are coloured to some extent and therefore impart to the goods treated with them, a yellowish or brownish tinge. Hence, for the production of light and brilliant shades, tannic acid, which is the purest and least coloured of all tannins, is used, and also decoctions of gall-nuts and decolourised sumac extracts, whilst for darker shades, sumac leaves, common extracts of sumac, myrabolans, knoppern, valonia, etc. are preferred on account of their lower cost.

The following are the most important tannins used in dyeing:

1) Tannic acid or gallo-tannic acid occurs in many tannin substances, especially in gall-nuts and in genuine sumac (from Rhus coriaria) and is chiefly prepared from the East Asiatic gall-nuts, which are very rich in tannic acid. It is found in the market in the form of lightly coloured powders or yellowish to brownish scales, or brittle and vitreous or loose and spongy masses, which become darker in the light. It dissolves in 6 parts of cold water, and still more readily in hot water, and is freely soluble in dilute alcohol, dilute acetic acid and glycerine. Alkaline solutions become strongly coloured.

2) Galls or gall-nuts are ball-shaped excrescences on various plants, formed by the stings of insects which thereby deposit their eggs. They must be collected before the young insect has pierced them. Of the oak galls, the green or black Aleppo galls and the Turkish or Levant galls are the best and contain about 55—60 % gallo-tannic acid. The Hungarian, Italian, French and German galls contain much less tannic acid. Chinese and Japanese galls contain up to nearly 80 % gallo-tannic acid, and are chiefly used for the production of pure tannic acid.

3. Knoppern are galls of a species of oak growing in Austria, which contain only 25—35 % gallo-tannic acid and are only little used in dyeing.

4. Sumac next to tannic acid is the tannin most generally employed in cotton dyeing. The sumac from Rhus coriaria is the

best and contains gallo-tannic acid. Sicilian sumac is the most valuable and least coloured quality. Next come the American sumac, which has been considerably improved during the last years, and the Greek, Spanish and Portugese sumacs. Inferior qualities are the sumacs from Hungary, Tyrol and Provence which are derived from Coriaria myrtifolia and Rhus cotinus.

Commercial sumac usually consists of the whole or the crushed or pulverised leaves; the stalks of the leaves and small stems are frequently admixed. Good qualities have an olive-green colour and a pleasant smell; they contain 15—20 % and sometimes over 25 % tannin. Sumacs, which are dull in colour and have a musty smell, have deteriorated by moisture and prolonged storing.

Sumac is chiefly used as a tannin for dark shades, whilst the dull reddish colouring matter it contains prohibits in most cases its use for light and brilliant shades.

Sumac extract is sold as a thick, dark brown liquid of about 52° Tw., or in the solid state. Decolourised sumac extracts may as a rule replace the tannic acid even for light shades.

Liquid sumac extract tends to fermentation, whereby it loses in strength.

5. Myrabolans are the fruits of several Chinese and East Indian plants which are brought into commerce in the dried state and ground to powder before use. They contain about 25—45 % ellagi-tannic acid and a yellowish-brown dyestuff. They are sometimes used in cotton dyeing for dyeing warps in unions black and for burl dyeing.

6) Valonia are the acorn cups of some species of oak growing on the coast of the Mediterranean, and contain 25—35 % tannin, probably gallo-tannic acid, and also a dull yellow dyestuff. They are used similarly to the myrabolans.

7) Divi-Divi or Libi-Divi are the leguminous fruits of a plant indigenous to Central and South America. They contain

about 19—35% ellagi-tannic acid and are also used similarly to the myrabolans.

The preceding and some other tannins are used in great quantities for dyeing cotton and weighting silk, especially black silk.

The value of the tannins varies considerably; it is however of no account whether they contain gallo-tannic or ellagi-tannic acid. For many purposes it is very important to know how much dull colouring matter they may contain. On prolonged storing, especially in damp musty rooms, the tannins deteriorate through the decomposition of the tannic acid.

The value of the tannins is best determined by an exact titration with permanganate and by a dye-test.

The dye-test is carried out by dissolving in hot water carefully weighed quantities both of the tannin to be estimated and of the one with which it is to be compared (of pure tannic acid about $^1/_2$ gramme). The solution is made up with water to 500 cc., 10 grammes of common salt are added, and 10 grammes of cotton yarn, previously well boiled off, are mordanted in the liquor for 3 hours. Each hank is then well wrung separately, but not rinsed, and turned for 15–20 minutes in a beaker containing 200 cc. nitrate or pyrolignite of iron $1^1/_2$—3° Tw.; after rinsing and drying, the two hanks are compared, and the strength of the tannin estimated by the depth of shade.

In order to ascertain whether a tannin is suitable for light shades, it may be fixed with antimony instead of an iron salt and dyed with basic dyestuffs, e. g. New Methylene Blue GG or Irisamine G; one quality of tannin may be better suited for blue shades, and another more adapted for red shades.

Weights and Measures.

Hydrometer and Thermometer Tables.

I. Metric System.

1 metre (m) = 10 decimetres (dm) = 100 centimetres (cm) = 1000 millimetres (mm).

1 litre (l) = 1000 cubic centimetres (cc or ccm). 1 cubic metre (cbm) = 1000 litres.

1 gramme (g or gr or grm) = 10 decigrammes (dg) = 100 centigrammes (cg) = 1000 milligrammes (mg).

1 kilogramme (kg or kilo) = 1000 grammes.

1000 kilogrammes = 1 ton (t) i. e. metric ton.

100 kilogrammes = 1 metric centner or quintal.

50 kilogrammes = 1 centner (or nearly 1 hundredweight).

10 grammes = 1 dekagramme (deka or Dg). 100 grammes = 1 hektogramme (hg).

The gramme is the standard unit of weight of the metric system and is equal to the weight of 1 cubic centimetre of pure water (measured whilst at its greatest density, in vacuum under a latitude of 45 degrees, at sea level). Hence the following relations of weights and measures are obtained:

1 cubic centimetre water = 1 gramme.
1 litre ,, = 1 kilogramme.
1 cubic metre ,, = 1 ton.

II. English Weights and Measures.

1 yard (yd) = 3 feet. 1 foot (′) = 12 inches (″). 1 inch = 12 lines (‴).

1 yard = 91.44 centimetres. 1 foot = 30.48 centimetres. 1 inch = 2.54 centimetres.

1 metre = 1.094 yards = 3.281 feet = 39.37 inches.

1 Imperial gallon (gall.) = 4 quarts (qts) = 8 pints (pts) = 32 gills.
1 Imperial gallon = 4.544 litres. 1 litre = 0.220 Imperial gallon.
1 pint = 0.568 litre. 1 litre = 1.76 pints.

In England by the term gallon (gall.) the Imperial gallon is meant, whilst in the United States of America the considerably smaller apothecary's or wine gallon is usually understood by this term. In England the ton or gross ton of 2240 lbs is also exclusively in use, whilst in the United States the term "ton" may refer either to the gross ton of 2240 lbs or the short ton of 2000 lbs avoir dupois. The weights and measures used in this book always refer to the Imperial gallon, and to the gross ton of 2240 lbs.

1 wine gallon = 4 quarts = 8 pints.
1 wine gallon = 3.785 litres. 1 litre = 0.264 wine gallon.
1 pint (apothecary's measure) = 0.473 litre. 1 litre = 2.114 pints (apothecary's measure).
1 Imperial gallon = 1.2 wine gallon. 1 wine gallon = 0.8335 Imperial gallon.
1 pound avoirdupois (lb) = 16 ounces (oz) = 256 drachms (drm)
1 pound avoirdupois approximately = 7000 Troy grains (gr)

1 ton (gross ton) = 20 hundredweights (cwt) = 2240 lbs.
1 hundredweight = 4 quarters (28 lbs each) = 112 lbs.

1 ton = 1016 kilogrammes. 1 pound avoirdupois = 453.593 grammes.
1 ounce = 28.349 grammes. 1 Troy grain = 0.065 grammes.
1 kilogramme = 2.205 lbs avoirdupois. 1 gramme = 15.434 Troy grains.

1 Imperial gallon holds 10 pounds avoirdupois or 70 000 grains water (measured at 62° F. under a barometric pressure of 30 inches).
1 wine gallon holds only 8.35 lbs water.

III. Russian Weights and Measures.

1 sagèn = 3 arshin = 7 feet.
1 foot = 12 inches. 1 arshin = 16 vershock.
1 foot = 30.48 centimetres. 1 inch = 2.54 centimetres. 1 Russian foot or inch equal to 1 English foot or inch respectively.

1 arshin = 71.12 centimetres. 1 vershock = 4.45 centimetres.
1 metre = 3.28 feet = 39.37 inches = 1.41 arshin = 22.50 vershock.

1 vedro = 8 stof = 12 quart = 30 krushki.
1 vedro = 12.30 litres. 1 stof = 1.54 litre. 1 quart = 1.02 litre.
1 litre = 0.0813 vedro = 0.9756 quart.

1 pood = 40 pound (Russian). 1 pound = 32 lot = 96 solotnik.
1 pood = 16.38 kilogrammes. 1 kilogramme = 0.06 pood.
1 pound (Russian) = 409.51 grammes. 1 lot = 12.48 grammes. 1 solotnik = 4.16 grammes.
1 kilogramme = 2.44 pounds (Russian).

In Russian Poland the following weights and measures are used:

1 ell = 2 feet = 0.81 arshin = 12.96 vershock.
1 foot = 12 inches = 0.945 Russian foot = 11.34 Russian inches.
1 ell = 57.6 centimetres. 1 foot = 28.8 centimetres.
1 pound = 32 lots = 0.99 Russian pound = 405.50 grammes.
1 centner = 4 stone = 100 pounds = 2.476 pud.

Comparison of the Thermometer Tables of Celsius or Centigrade, Fahrenheit and Réaumur.

Degrees			Degrees			Degrees		
Celsius	Fahrenheit	Réaumur	Celsius	Fahrenheit	Réaumur	Celsius	Fahrenheit	Réaumur
0	32.0	0.0	34	93.2	27.2	68	154.4	54.4
1	33.8	0.8	35	95.0	28.0	69	156.2	55.2
2	35.6	1.6	36	96.8	28.8	70	158.0	56.0
3	37.4	2.4	37	98.6	29.6	71	159.8	56.8
4	39.2	3.2	38	100.4	30.4	72	161.6	57.6
5	41.0	4.0	39	102.2	31.2	73	163.4	58.4
6	42.8	4.8	40	104.0	32.0	74	165.2	59.2
7	44.6	5.6	41	105.8	32.8	75	167.0	60.0
8	46.4	6.4	42	107.6	33.6	76	168.8	60.8
9	48.2	7.2	43	109.4	34.4	77	170.6	61.6
10	50.0	8.0	44	111.2	35.2	78	172.4	62.4
11	51.8	8.8	45	113.0	36.0	79	174.2	63.2
12	53.6	9.6	46	114.8	36.8	80	176.0	64.0
13	55.4	10.4	47	116.6	37.6	81	177.8	64.8
14	57.2	11.2	48	118.4	38.4	82	179.6	65.6
15	59.0	12.0	49	120.2	39.2	83	181.4	66.4
16	60.8	12.8	50	122.0	40.0	84	183.2	67.2
17	62.6	13.6	51	123.8	40.8	85	185.0	68.0
18	64.4	14.4	52	125.6	41.6	86	186.8	68.8
19	66.2	15.2	53	127.4	42.4	87	188.6	69.6
20	68.0	16.0	54	129.2	43.2	88	190.4	70.4
21	69.8	16.8	55	131.0	44.0	89	192.2	71.2
22	71.6	17.6	56	132.8	44.8	90	194.0	72.0
23	73.4	18.4	57	134.6	45.6	91	195.8	72.8
24	75.2	19.2	58	136.4	46.4	92	197.6	73.6
25	77.0	20.0	59	138.2	47.2	93	199.4	74.4
26	78.8	20.8	60	140.0	48.0	94	201.2	75.2
27	80.6	21.6	61	141.8	48.8	95	203.0	76.0
28	82.4	22.4	62	143.6	49.6	96	204.8	76.8
29	84.2	23.2	63	145.4	50.4	97	206.6	77.6
30	86.0	24.0	64	147.2	51.2	98	208.4	78.4
31	87.8	24.8	65	149.0	52.0	99	210.2	79.2
32	89.6	25.6	66	150.8	52.8	100	212.0	80.0
33	91.4	26.4	67	152.6	53.6			

Comparison of Hydrometer Degrees Twaddle and Baumé with the Specific Gravities for Liquids heavier than Water.

Degrees Twaddle	Degrees Baumé	Specific Gravity	Degrees Twaddle	Degrees Baumé	Specific Gravity	Degrees Twaddle	Degrees Baumé	Specific Gravity
1	0.7	1.005	58	32.4	1.290	116	53.0	1.580
2	1.4	1.010	60	33.3	1.300	118	53.6	1.590
4	2.7	1.020	62	34.2	1.310	120	54.1	1.600
6	4.1	1.030	64	35.0	1.320	122	54.7	1.610
8	5.4	1.040	66	35.8	1.330	124	55.2	1.620
10	6.7	1.050	68	36.6	1.340	126	55.8	1.630
12	8.0	1.060	70	37.4	1.350	128	56.3	1.640
14	9.4	1.070	72	38.2	1.360	130	56.9	1.650
16	10.6	1.080	74	39.0	1.370	132	57.4	1.660
18	11.9	1.090	76	39.8	1.380	134	57.9	1.670
20	13.0	1.100	78	40.5	1.390	136	58.4	1.680
22	14.2	1.110	80	41.2	1.400	138	58.9	1.690
24	15.4	1.120	82	42.0	1.410	140	59.5	1.700
26	16.5	1.130	84	42.7	1.420	142	59.9	1.710
28	17.7	1.140	86	43.4	1.430	144	60.4	1.720
30	18.8	1.150	88	44.1	1.440	146	60.9	1.730
32	19.8	1.160	90	44.8	1.450	148	61.4	1.740
34	20.9	1.170	92	45.4	1.460	150	61.8	1.750
36	22.0	1.180	94	46.1	1.470	152	62.3	1.760
38	23.0	1.190	96	46.8	1.480	154	62.8	1.770
40	24.0	1.200	98	47.4	1.490	156	63.2	1.780
42	25.0	1.210	100	48.1	1.500	158	63.7	1.790
44	26.0	1.220	102	48.7	1.510	160	64.2	1.800
46	26.9	1.230	104	49.4	1.520	162	64.6	1.810
48	27.9	1.240	106	50.0	1.530	164	65.0	1.820
50	28.8	1.250	108	50.6	1.540	166	65.5	1.830
52	29.7	1.260	110	51.2	1.550	168	65.9	1.840
54	30.6	1.270	112	51.8	1.560	169	66.1	1.845
56	31.5	1.280	114	52.4	1.570	170	66.3	1.850

Note:

The degrees in Twaddle's hydrometer bear a direct relationship to the specific gravity and may be obtained from the same by the following formula in which d represents the specific gravity and n the number of degrees Twaddle: $n = \frac{1000\,d - 1000}{5}$. On the other hand by the formula

$d = \frac{5n + 1000}{1000}$ the degrees Twaddle are converted into the corresponding specific gravity. For values below 2.0 the degrees Twaddle may also be obtained from the specific gravity by moving the decimal point two figures to the right, striking off the first figure and multiplying the rest by 2, as per the following example:

Specific gravity 1.133:
113.3:
13.3×2:
26.6° Twaddle.

Comparison of Hydrometer Degrees Baumé with the Specific Gravity of Liquids lighter than Water.

Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity	Degrees Baumé	Specific Gravity
11	0.993	16	0.960	21	0.930	26	0.901
12	0.987	17	0.954	22	0.924	27	0.896
13	0.980	18	0.948	23	0.918	28	0.890
14	0.973	19	0.942	24	0.913	29	0.885
15	0.967	20	0.936	25	0.907	30	0.880

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